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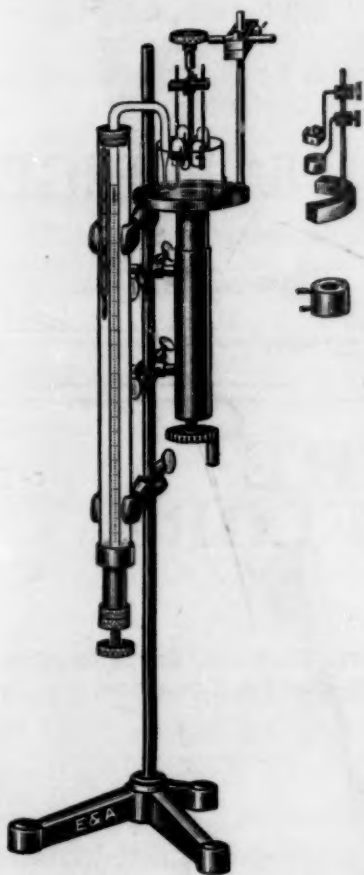
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SCIENCE

VOL. 83

FRIDAY, JUNE 26, 1936

No. 2165

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THE SEMI-CENTENNIAL CELEBRATION OF THE SOCIETY OF SIGMA XI¹

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND THE SOCIETY OF SIGMA XI

THE president of the American Association for the Advancement of Science has been asked to extend the greetings and congratulations of the association to the

¹ Held at Cornell University on June 19 and 20. After the introductory addresses here given, there was an address by Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, on "The Service of Sigma Xi in the Universities of the Future." This was followed by a reception and a buffet dinner in Willard Straight Hall. In the evening Dr. Max Mason, president of the Rockefeller Foundation, gave an address on "Science and the Rational Animal." On Saturday morning Dr. William F. Durand, president of Sigma Xi, presented the semi-centennial prizes, and addresses were given by Dr. Willis R. Whitney, vice-president of the General Electric Company, on "The Accomplishments and Future of the Physical Sciences" and by Dr. Frank R. Lillie, of the University of Chicago, president of the National Academy of Sciences, on "The Accomplishments and Future of the

Society of Sigma Xi on the fiftieth anniversary of its birth and to point out the parallelism between these two organizations. Both have one function in common, the promotion of science, both seek to accomplish this by scientific meetings and publications and by the award of honors and grants-in-aid of research. But the association seeks to correlate all branches of science and to secure the cooperation of all persons who are seriously interested in its promotion, while Sigma Xi is an honor society for those who have shown ability as investigators and who constitute a selected group of "Companions in Zealous Research."

The American Association is the largest, most democratic and one of the oldest scientific bodies on this continent. It was organized in 1848, though its antecedents go back to the American Geological Society, Biological Sciences." The concluding exercises consisted of the presentation of the Sigma Xi Memorial in front of Sibley College.

which was founded at Yale in 1819. The association now consists of 15 sections, representing different branches of science, and it has more than 18,000 members residing in all parts of the United States, Canada, Mexico and in nearly 60 foreign countries. Associated or affiliated with it are over 150 other scientific societies, with a total membership of more than 500,000 persons. One of these affiliated societies is Sigma Xi.

The association is thus one of the most important organizations in the world for the promotion of science. It is a forum before which scientists bring their discoveries and theories for discussion and criticism; it is a migratory educational institution, which by means of public lectures and exhibitions in different cities carries the spirit, aims and results of science to the general public; it is an important factor in helping to solve some of the most serious social problems of the present day.

These two organizations, as well as the many special scientific societies, have for their object "the increase and diffusion of knowledge among men." Each of our societies supplements and complements the other. In 1921 the association invited Sigma Xi to cooperate in our annual meetings by providing a Sigma Xi lecture and these have been outstanding events of convocation week.

The American Association for the Advancement of Science congratulates the Society of Sigma Xi upon its notable record and wishes for it a future of ever greater service to science and mankind. We are especially appreciative of the program of this semi-centennial celebration, which emphasizes the relation of scientific research to social progress.

This last is a particularly live topic at this time when many persons are charging that science is responsible for wide-spread unemployment and are suggesting that scientific research should be halted until social progress has had time to catch up—which would certainly never happen. The depression has brought out a flood of books and articles on this subject, non-scientists often calling for a moratorium on research, while scientists call for an extension of science and scientific methods to the solution of social problems. Eminent British scientists have shown that modern society does not suffer from too much science, but from the "frustration of science" by the present social order. This is certainly a timely topic for a society devoted to the promotion of scientific research.

The marvelous advances in the production of food and clothing, of housing and transportation that have been made possible by science are known of all men. How has the social order met these advances? Superabundance of farm products is said to be one of the greatest social problems. And so on the one hand we find governments destroying or limiting the produc-

tion of coffee, sugar, cotton, corn, hogs, calves, milk, potatoes, while on the other hand agricultural departments, colleges and institutes strive to increase them. It is easy to point out this absurdity, but not so easy to prescribe a remedy. However, it is certain that scientific progress in agriculture and industry will continue and the remedy must be found in a wider distribution of the products of scientific research.

In similar manner scientific progress in medicine and sanitation is far in advance of its social utilization but not in advance of its urgent need. Knowledge of heredity, eugenics, birth control and the means of improving our human stock is so far in advance of its practical application that the race is likely to suffer irreparable loss before this knowledge is put in practice.

And in similar fashion it might be shown that scientific progress in finding ways of protecting society against criminals and social parasites is far in advance of its general adoption; that rational and peaceful means of preventing wars are vastly less costly and more effective than armaments; that scientific control of population and the necessities of civilized life are far more humane and progressive than to leave these to nature and the law of the jungle. Here are some of the appalling contrasts between *scientific progress* and *social stagnation*:

Overproduction	<i>contra</i>	Underconsumption
Improved transportation	"	Unimproved distribution
Vast prosperity	"	Appalling poverty
Multiplied occupations	"	Unparalleled unemployment
Triumphant medicine	"	Widespread disease
Prolonged life	"	Useless and dependent old age
Scientific internationalism	"	Economic nationalism
Greater armaments	"	Less security
Larger social units	"	Less social unity
Elimination of unfit and survival of the fit	"	Protection of the unfit and elimination of the fit

The longer this list is made the more it appears as a conflict between progress and stagnation, knowledge and conduct, science and the social order.

It is easier to recognize symptoms than to diagnose causes, and both are easier than to prescribe remedies. The most fundamental cause of these contrasts is the conflict between altruistic science and acquisitive society, one working for abundance, the other for scarcity; one for goods, the other for prices. The profit motive is probably inevitable and not wholly undesirable, but in any stable society it can not be the chief or only motive.

Different nations are now trying different remedies for this disparity between scientific knowledge and social practice. Communism, in so far as it is based upon the ideal that all men are equal in ability or character or social value, is scientifically false. In a democratic society all men are not and never will be equal in power, wealth or social value, but they do have equal rights to life, liberty and opportunity. Leadership of wealth may be as useful as any form of leadership—witness our great educational, charitable and scientific institutions established by private endowment. All "share the wealth" programs would be ineffective to change effectively the present status. Sharing all income above \$5,000 would give only \$200 to each of twenty million families, or approximately \$50 to every man, woman and child in the United States.

Fascism is no satisfactory solution of the problem of insuring life, liberty and opportunity to every person. It destroys liberty of press, speech, thought and conscience; it censors science and religion, reduces the mass to the condition of robots and cannon fodder. It is based on war psychology, does not educate the people for peace and freedom, puts everything under a dictator who must maintain a reputation of supernatural grandeur. It may work well for a time, but always ends in disaster.

"Rugged individualism" in the sense of "every man for himself and the devil take the hindmost" is no remedy for the present ills of society. We have had too much of this in the past to be content to go back to it now. It served well in a pioneer stage of society, but will not work in a crowded state.

Democratic socialism seems to me the safest and sanest social order. It avoids the extremes of communism, fascism and individualism, and yet contains elements of all these, and as such it conforms to that inexorable biological principle of the necessity of preserving balance between contrasting principles or opposing forces. Fanatical extremes of individual freedom or of social regimentation have no successful prototypes in biological or human history. Democratic socialism best preserves this balance in the social order.

It best preserves freedom of experimentation. The scientific method of learning is by experiment, trial and error, and finally trial and success. There is no other path of progress. Many mistakes are made, but with freedom to experiment they will be eliminated. This is the great advantage of free government. In this sense it is true, as Lincoln said, that "A free government is better than a good government."

Democratic socialism is best for the education of the masses. The ultimate aim of all education, whether of children or nations, should be to fit for freedom and

cooperation, and both children and nations must learn by experimentation.

The spirit of science and the method of science must spread to society and government. Scientists must take a more active part in solving social problems. Such progress will be slow but sure. Science and ethics are the chief hopes of social progress.

EDWIN G. CONKLIN

PRINCETON UNIVERSITY

RESPONSE TO ADDRESSES OF WELCOME

President Farrand, of Cornell University, and President Conklin, of the American Association for the Advancement of Science:

ON behalf of the Society of Sigma Xi, let me thank you most warmly for the gracious and kindly words with which you have signalized this occasion—the fiftieth anniversary of the birth of Sigma Xi. Our appreciation to you, President Farrand, because you represent Cornell University, the place of our birth, the source of our early inspirations and the mecca of our members on this, our fiftieth birthday; and to you, President Conklin, because you represent the American Association for the Advancement of Science, the fostering mother of the organization of science in our country, and because we are honored here to-day by the presence of that great organization in an official and collective sense, as a participant in the events which are intended to mark this occasion.

We thank you both for your kindly words and for the generous terms with which you have referred to our society and to its work during this first half century of its life.

In particular, I would wish that your kindly welcome and generous words should be understood as intended, not only for those who have the good fortune to be here present on this occasion, but also, more widely, for all our members, no matter where they may be found, in this broad land or beyond the seas. Doubtless they are here in spirit, perhaps through the wizardry of modern radio; others, at a later time, may read in printed word some account of these exercises, and I would hope that all such will feel that your words are addressed to them as well as to those within the immediate reach of your spoken words.

We are, as you have said, here to celebrate the fiftieth anniversary of the organization of the scientific honor Society of Sigma Xi. The present moment is not the time for any detailed reference to the history of this event or to the history of the society during this past half century. This will come appropriately at a later time in our exercises as you will note from your programs.

If I may, however, be allowed a word, more personal in import, I would take the opportunity of ex-

pressing my own deep personal feeling and interest in this occasion. Coming to Cornell when the society was only five years old, and accepted as a member, I remained for thirteen years in this atmosphere which has engendered the Society of Sigma Xi and which had sent it on its mission throughout our broad land. The memories of the birth of the society were still fresh in those years. I have known personally three of the founder members of the society, and among them Henry Shaler Williams of blessed memory. From one of the others, Professor C. B. Wing, now emeritus professor of civil engineering at Stanford University, I bring sincere regrets that he can not be present with us on this occasion, together with warm greetings to you all.

For these reasons, from my early acquaintance and association with these pioneers of our society, by reason of my period of thirteen years spent most delightfully in the intellectual, social and physical environment which Cornell affords, the present occasion holds for me a peculiarly keen and special interest.

And so, through the years which have passed since those beginnings, our society has come to the mid point of the century. Of our history during that period, you will, as I have said, hear more in a moment. But in reviewing the past, we must not forget the future. The past has gone beyond recall. The future is still before us. We may draw lessons from our experience of the past; we have the future in which to apply these lessons. Let us, then, while we think of the past, keep our faces toward the future with a firm resolve that, so far as in us may lie, the future of our society shall show an ever rising gradient of progress in the scope and effectiveness of its service to the cause of science and the scientific training of the young.

Again, let me express to you both our profound appreciation for your words of welcome and cheer to us on this occasion.

WILLIAM F. DURAND

STANFORD UNIVERSITY

BRIEF HISTORY OF SIGMA XI

THE Society of the Sigma Xi is a fifty-year old youth movement on a high level and a large scale. It was started on the campus of Cornell University in 1886 by nine young students under the guidance, but not the control, of the justly well-known geologist, Professor Henry Shaler Williams. Its purpose has always been to promote research in pure and applied science. The method followed in the pursuit of its object has always been the encouragement and recognition of excellence of college and university undergraduates and graduates in the pursuit of science courses. It associates into one body all students who exhibit special ability in

science, regardless of the field of endeavor. The preamble of the first constitution sets forth this object and this method definitely.

Friendship in Science. While those whose heart and soul is in their work, are coping with the great problems of Nature, let them remember that the ties of friendship can not be investigated, but only felt. Let them join heart and hand, forming a brotherhood in Science and Engineering; thus promoting and encouraging by those strong, personal attachments of friendship, the highest and the truest advances in the scientific field. To lend aid and encouragement to those newer brothers, who likewise laboring in the same sphere are aspiring to honored positions. And in collegiate halls to award an honor, which to scientific recipients shall signify, "Come up higher."

During the first quarter century of the society's history, branches of Sigma Xi were established in 28 institutions in which science and technology were notably strong, and 300 young men and women of marked accomplishment in science courses were annually elected to membership.

For 25 years the activities of the national organization were a summation of the activities of the 28 individual units. But in 1913 and 1914 it began to appear that the society as a whole was confronted with problems which affected not one chapter, or several chapters, but all chapters alike. A national policy became necessary. The first of these questions was connected with the inevitable expansion of the society. What institutions should be given charters for chapters? A strict definition of conditions was made—president and trustees of an institution contemplating a chapter must be favorably disposed toward research; there must be apparatus and facilities available for research; there must be members of the faculty who have had adequate training for research; there must have been a continuous output of research for a number of years; there must be appropriations for research.

A second national problem arose about this time—what should constitute eligibility for election of young men and women into the society? All students in the institutions where there were chapters had had opportunity to show excellence in science by their scholastic record, but only a very few had had a chance to exhibit an aptitude for scientific research by actual research work. The situation in the universities and colleges themselves made necessary a distinction among candidates for election into the society, and eligibility requirements were strictly defined. Those students were eligible to membership who, as judged by actual scientific investigation, had exhibited an aptitude for research; and those were eligible to associateship who had shown marked excellence in one or more departments of pure and applied science. In both cases it

was always the ability of youth that was recognized and rewarded.

The second quarter century of the society's history has seen further development of national policies as distinct from chapter activities, but the purpose of the organization as originally expressed by the nine young men who started it has never been lost sight of—the promotion of research in pure and applied science. On the contrary, the society as a whole is realizing its object to-day more substantially than at any time in its history. The 28 chapters of 1911 have grown to 68 chapters in 1936. Chapters are no longer limited to the United States. Canadian institutions have been recognized, and inquiries about chapters in England and Europe have been received. Instead of 300 young men and women elected annually into the society, there are now some 1,200. A constituency of 7,500 in 1911 has become nearly 35,000 in 1936. The membership of 1911 was largely limited in residence and work to the United States. Members and associates of Sigma Xi in 1936 are residing and engaging in scientific research in fifty-five different countries of the world.

National policies have expanded. The society realizes the fact that there are youths in institutions where there are no chapters who have shown excellence in one or more scientific courses, and since 1934 has issued to such individuals certificates in commendation of their work. Over two thirds of the society's constituency are either not connected with any educational institution, or if they have such connection, it is with institutions where there are no chapters. This large group are many of them engaged in actual research, and all of them are interested in the promotion of research. Sigma Xi clubs are authorized to organize wherever there is an interested group of members and associates, and since 1921 Sigma Xi members and associates outside educational institutions have been supporting a Sigma Xi Research Fund, which is distributed by the national organization in small grants-in-aid of research to young men and women who are carrying on scientific investigations in institutions of limited resources. The close of fifty years of constantly expanding activity is signalized by the award of two prizes of \$1,000 each, not for research accomplished, but to young research workers in recognition and support of research in progress—one award to a worker in the biological sciences and one to a worker in the physical sciences.

Thus throughout its fifty years of life, the Society of the Sigma Xi has recognized and rewarded ability in science on the part of young men and women. It is in that important aspect of its policies—the encouragement of youth—that lies the ground for its prominent position among scientific organizations, the explanation of the influence it exerts on the advancement of

science all over the world and the confidence its supporters everywhere express in its brilliant future.

EDWARD ELLERY

UNION COLLEGE

THE INCEPTION OF THE SOCIETY OF THE SIGMA XI

IN an examination of the addresses delivered during this commencement season at the various universities of the country, it appears that the main theme is the outlook upon the future—but to me there has been assigned the task of looking backward, and to neglect being a prophet of the future, for all prophets are on uncertain ground, and to give the salient facts of the past which led to the inception of the idea for the organization of the Society of the Sigma Xi.

The need of a society in colleges to recognize the scientific spirit and acknowledge research was not altogether new fifty years ago. Science in fact was energetically pushing up its head amid the devotees of classical culture, and it was occasionally accentuated by profound scholars that the study of the classics, Greek and Latin, while of a certain cultural value, were not of necessity a mental or even educational training such as best fitted students for a scientific career nor for deep research nor even as a preparation for the activities of life.

As a junior student at the Stevens Institute of Technology, there came to my attention a commencement day address before the Phi Beta Kappa Society at Harvard on June 28, 1883, by Charles Francis Adams, Jr., of Boston, for which he selected the unique title "A College Fetich." This address stirred the classicists from one end of the country to the other, and even had its rebound into England and Germany.

First let us indicate who this Charles Francis Adams, Jr., was. At the time he was president of the Union Pacific Railway—hence spoke as one with authority. He was one of the celebrated family of Adams that had supplied two presidents of the United States—and in passing we can now say that a recent Adams of the same name was our Secretary of Navy during the Hoover Administration). This Phi Beta Kappa address seriously challenged all claims for the study of the dead languages to have educational value. In fact, he said that this study of the Greek and Latin had been like a millstone about the necks of all the family and all others who aspired to careers in science or even in politics and diplomacy, and such study as feats of memorizing was the correct thing for those who expected to become professors of these languages; but that as working tools of life, a knowledge of French, German and Spanish was far preferable, and that for close and exact mental drill, the higher mathematics, chemistry, biology and electricity were then most essential.

Let us quote some of Charles Francis Adams's surprising phrases which still cause students of these fifty years later to think. He states, talking to his classmates of 1856:

And so looking backward from the standpoint of 30 years later and thinking of the game of life which has now been lost or won, I silently listen to that talk about "the severe intellectual training" in which a parrot-like memorizing did its best to degrade boys to the level of learned dogs, and further "we want no more classical veneer whether on furniture or education, we do not admire veneer."

These were indeed harsh words, from one of a family steeped in the classics; and thus delivered before the Phi Beta Kappa Society, they caused one to think, whether that society's insistence on the classics was well taken, and if so insisted upon whether another society should not be established to recognize high standing of those following scientific studies.

Do not conclude from this that your speaker himself had an aversion to such classical studies—for my own father was a deep classicist and in the ministry delved deeply not only into his Greek and Latin, but into Hebrew and the Germanic languages, and the intention was that his son should follow in his profession.

The son, captivated by the researches of Alexander Graham Bell into telephonic electricity and Edison into the phonographic recording and the incandescent lamp, early decided for himself that the classics had nothing comparable to offer in the pursuit of these new rapidly growing sciences. It should be recalled that these sciences and the researches connected therewith had but barely started fifty years ago, and the crude developments of that time if recounted to you would seem now almost improbable to the young trained scientists of to-day who work with instruments whose names and measurements were then not even evolved.

Finding myself on the instructing staff at Cornell University in 1885 in the Sibley College of Mechanical Engineering, soon friendships of all kinds were made among such instructors and among students, and shortly thereafter four of such were gathered together in one group at a boarding house—still highly remembered for its homelike atmosphere fostered by a most kindly and lovable landlady. Of these four friends—two were deep classicists and two were engineers. Our classical friends, Burr and Thurber (Burr later became a professor in Cornell and Thurber an authority with Ginn and Company, publishers). Both of these attempted to console the two engineers (Van Vleck and Wing—both later becoming professors) that the rewards of an honorary election to the great Society of the Phi Beta Kappa were not for those so

soaked in science as we were, and who could not read in the original Caesar's Commentaries nor enjoy the orations of Thucydides or some other Grecian. Thus we did not hold any particular sorrow that we had missed such an honorary election, and both Wing and myself made the pronouncement that a new honor society for scientific men only would in time duly arise—but little did we two dream that we would be the agents for such a new and untried organization, either at Cornell or any other institution.

This start was even sooner than anticipated—and was brought forward by the suggestion of Mr. W. A. Day, Cornell, '86, to myself as we toiled up the Ithaca hill from town in 1886, essentially as recounted in a letter appearing in the quarter century volume of Sigma Xi.

The organizing machinery was soon put in motion, and in the fall of 1886, shortly after the opening of the university, these plans were put into effect.

Here it should be said that our plans were often talked over with our room-mates Burr and Thurber, and they gave much excellent advice, although we jokingly informed them that as sincere friends we could not award them any honor of an election, as, being mere classicists, they could not understand the deep "cultural advantage" to be obtained from a close and exact study of the sciences.

Again these classical friends did come to our aid, for when the subject came up for a new name for the society Mr. Burr at once said, "Don't make the mistake of calling the new society with an English name, but give it at once a Greek classification name—much as you dislike reference to the classics, and if for nothing else the use of Greek initials marks it at once as a thoroughgoing collegiate organization." This appeared sound advice, and it was determined that I should canvass among all the even then large number of Greek fraternities and select some set of Greek initials that had not already been preempted by some other fraternity. There were not many such initials available, but we did find that Sigma Xi was not in use; then came the problem of a definite Greek motto to fit these initials. Wing and myself, having no knowledge of Greek much beyond its alphabet, were helpless, but Burr suggested, "Give me a little time and I can find it for you." Later he evolved the two-word motto and referred it to the then professor of Greek, who polished it up for accent or something. Still later then Professor Henry Shaler Williams, head of the department of geology, was brought in. We had him look over the motto and he approved it without a change, and so it has remained ever since.

An idea of the motto was also that of confirming the thought of a friendship among scientific workers, as it had been observed that in the records of European

scientists, as Faraday, Helmholtz and others, there had often been an interchange of scientific views between scientists even when differing in nation and often in language, indicating that they were working as friends and often comparing notes as to their difficulties, whereas in America, outside of the special professional societies, there at that time appeared to be little in the way of close intimacy among scientists themselves. Research workers themselves often need this feature of the personal contact, with some one who can think along the same lines as they are working upon.

As one of this diminishing group of the nine found-

ers of this society, permit me to extend our appreciation of the efforts of the officers of the society and of the Cornell chapter to have us all here for this semi-centennial celebration, and to witness the dedication of the handsome monument on this campus, as a fitting mark of this event.

And this little group of founders desire to thus express their deepest sense of appreciation for the excellent administration that has distinguished this society in every phase of its existence for these fifty years and to wish for the continuance of the great and good work of the society for the years to come.

FRANK VAN VLECK

OBITUARY

ARTHUR A. NOYES

ON Wednesday morning, June 3, Arthur A. Noyes died of pneumonia at Pasadena, California, three months before his seventieth birthday. During the past twenty years in which I have been intimately acquainted with him he has never been in robust health, and two years ago he underwent an operation which further weakened his resistance and from the results of which he suffered continually until the time of his death.

Few men have played a larger rôle in the development of American science than Arthur A. Noyes. He was born at Newburyport, Mass., on September 13, 1866; took his bachelor's degree in organic chemistry from the Massachusetts Institute of Technology in 1886, his master's in 1887 and the next year went to Leipzig and started organic chemical research with Wislicenus, but under the influence of Ostwald soon joined the group of young men who were then devoting themselves to the creation of the new subject of physical chemistry. After taking his doctorate in Leipzig in 1890 he returned to the Massachusetts Institute of Technology and for ten years was actively engaged in that institution in teaching analytical, organic and physical chemistry. During this period he published his well-known work on qualitative analysis which has exerted a very large influence in this country. Also during this period he carried out with his students so many researches on the ionic theory of electrolytes that he became recognized both here and abroad as one of the most outstanding leaders of American chemistry. In 1903 he established at the Massachusetts Institute of Technology and became the director of the first Research Laboratory of Physical Chemistry, and for seventeen years personally contributed half the expense of its maintenance. He never married but devoted every ounce of energy that he possessed to the development of his chosen field, chemistry.

Nothing reveals the extent of Noyes's influence

better than the roster of the output of that laboratory in men, for on it are found such names as W. D. Coolidge, G. N. Lewis, W. C. Bray, R. C. Tolman, C. S. Hudson, E. W. Washburn, R. B. Sosman, W. D. Harkins, John Johnston, C. A. Krauss, F. G. Keyes and others.

The wide sweep of his influence is also shown by the fact that he acted as president of Massachusetts Institute of Technology from 1907-1909, and was president of the American Association for the Advancement of Science in 1927. In the councils of the American Association, the National Research Council and the National Academy of Sciences he was universally felt to be as objective a thinker, as wise a counselor and as discriminating a formulator of policies as could be found in this country.

From 1913 on he began to divide his time between the Massachusetts Institute of Technology and the California Institute of Technology, and in 1916 organized, built and became the director of the Gates Chemical Laboratory, the first building after Throop Hall to rise on the campus of the latter institution.

The contribution of Arthur A. Noyes to the creation of the California Institute of Technology, to which he devoted his whole time after 1920, is beyond all measure. His rare judgment, his fertile imagination, his conscientious devotion to the institute's welfare, his long educational experience and profound understanding, his breadth of vision, his research enthusiasm, his unwavering forward look, his innate refinement (he was a great lover of poetry)—all these qualities combined to make him a man of rare ability and effectiveness. But he was more than an able man; the far reach of his influence came from the fact that he possessed the greatest and the rarest of all qualities, complete unselfishness. When he had once seen clearly a great objective, he forgot, as few men I have ever known have been able to forget, all about his own place in the picture.

This is why he was the trusted adviser of all who knew him, faculty and students alike. This was the secret of his influence. The world is quick to sense, to appraise and to follow a character that every one can trust. Over and over again our enterprise might have been ruined if a man of narrower vision and smaller soul had been a guiding spirit. Over and over again he deliberately pushed his own interests out of the picture and chose the course which led to the remoter but larger goal. With his early arrival on the scene and his great prestige and influence, he could easily have followed the course which lesser men would have undoubtedly pursued, and built this institution around himself and his department; but he realized that the larger objectives required that other departments be made significant, too, and he threw his own energies into building them, sometimes even at the immediate expense of his own. He spent more time than any other man on the campus trying to create here outstanding departments of physics, of mathematics, of the humanities, of geology, of biology and of the various branches of engineering, and what these departments are to-day they owe more than they themselves know to Arthur A. Noyes. The breadth of his vision is shown by the fact that from the first he was the foremost and most effective advocate of the view, first, that really great engineers can not be produced in an atmosphere that ignores the fundamental sciences upon which all engineering ultimately rests, and, second, that neither effective scientists nor engineers can be created in an atmosphere which is not permeated by the background of the disciplines that deal with human values, motivations and experience. In all the fields in which the institute thinks that it has done and is still doing educational pioneering, Arthur A. Noyes has been the leader. The last great act of his life was altogether typical of the man. He had been pondering, as he was always doing, over the needs and the opportunities of the institute, and he saw clearly another step having nothing to do with

chemistry that had to be taken; but he knew the financial difficulties in the way. So he went to the trustees and said, "Take what this costs out of my own personal income but do not hesitate for a moment to take this necessary step." Is it any wonder that we at the institute feel that the atmosphere of mutual assistance and self-forgetting cooperation toward a great ideal which has been created here and which is to-day the most priceless asset of this institution is largely the legacy of the mind and the soul of Arthur A. Noyes? We can not pay the debt which we owe to him by any words of eulogy or praise. "It is rather for us to be here dedicated to the great task remaining before us," that the spirit and ideals and accomplishment of Arthur A. Noyes shall not perish from the earth.

ROBERT A. MILLIKAN

CALIFORNIA INSTITUTE OF TECHNOLOGY

RECENT DEATHS

DR. JAMES TATE MASON, president of the American Medical Association, died on June 20. He was fifty-four years old.

DR. BLAIR SAXTON, associate professor of chemistry at Yale University, died on June 16 at the age of forty-five years.

DR. JOHN HUGHES MÜLLER, professor of chemistry at the University of Pennsylvania, died on June 18. He was fifty-three years old.

DR. J. FINLEY BELL, of the Englewood, N. J., Hospital, known for his work on the bacteriology of milk, died on June 16 at the age of seventy-six years.

FRANK MERRICKS, British consulting mining engineer, past president of the British Institute of Mining Engineers, died on June 6 at the age of seventy years.

DR. HAMILTON CLELLAND MARR, formerly lecturer on mental diseases at the University of Glasgow, died on June 15. He was sixty-five years old.

SCIENTIFIC EVENTS

THE ALLOYS OF THE IRON RESEARCH COMMITTEE OF THE ENGINEERING FOUNDATION

APPOINTMENT of three representatives of the steel industry to the Alloys of Iron Research Committee of the Engineering Foundation, which is carrying on world research embracing the entire body of knowledge of steel, alloy steel, alloy iron, and cast, wrought and pure iron, has been announced. Dr. John Johnston, director of research of the United States Steel Corporation, was named to the committee to represent the American Iron and Steel Institute; Wilfred Sykes, a

director of the Inland Steel Company, becomes a member-at-large, succeeding the late Dr. John A. Mathews, who was vice-president of the Crucible Steel Company of America. The other new member is James T. Mackenzie, metallurgist and chief chemist of the American Cast Iron Pipe Company, who takes the place of R. E. Kennedy, technical secretary of the American Foundrymen's Association.

Nearly 150 specialists in alloy steels, physical and works metallurgists, physicists, chemists, engineers and superintendents of alloy-steel plants, are cooperating with the committee, of which Professor George B.

Waterhouse, of the Massachusetts Institute of Technology, is chairman.

The committee's collection of classified abstracts now numbers 15,300, with foreign languages translated into English. Six monographs have been issued, nine are in preparation and five more are planned. Two volumes on the alloys of iron and carbon will shortly appear. The manuscripts on the alloys of iron and chromium are 80 per cent. drafted for examination by the committee's advisers and consulting editors. The iron-nickel manuscripts are approximately 50 per cent. and 25 per cent., respectively, completed. For the iron-manganese monograph, the data have been assembled, including results of basic research conducted with the aid of the Foundation at Carnegie Institute of Technology. The literature review of the iron-vanadium monograph is almost finished. Preliminary work for the study of cast iron is progressing.

The work, on which about \$125,000 has been spent, is officially described as "the most extensive search of a branch of technical literature ever undertaken" and "the most comprehensive, if not the only collection of such data in the world." In addition, the data assembled by the committee and published in its books give to the practical steel or iron maker or user a concise summary of the characteristic quality of each alloy steel or iron now being used, and an unbiased discussion of its advantages and disadvantages for each particular application. These summaries have been made possible only by searching through thousands of reports in many languages; correlating and evaluating the information and condensing it into readily usable form.

THE THIRD WORLD POWER CONFERENCE

The third World Power Conference will be held at Washington from September 7 to 12. This is the first conference to be held in America and is the first to stress economic rather than technical problems.

The purposes of the conference are to examine the part played by power in all technical, economic, social and public bearings; to provide a forum for the interchange of data and ideas; to dramatize the rôle of power in the modern world.

The American National Committee, which is planning the conference, includes representatives of engineering and technical associations, the trade associations of the electrical, coal, gas and petroleum industries, public-utility corporations, government bodies dealing with power, technical schools, engineers, economists, leaders of labor and representatives of the consumer.

Secretary of the Interior Ickes is chairman of the American committee; Morris L. Cooke is chairman of the executive committee; O. C. Merrill is director of

the conference, and Dr. William F. Durand will be chairman.

As many as seven hundred official members are expected to be present from Europe alone, and some 3,000 altogether may be in attendance. There will be a special effort to secure a large attendance from Latin America. The English, French, German and Spanish languages will be used.

So much stress was laid on technical matters at previous conferences that, in response to a very general desire, the program for the Washington conference will approach the power problem from the economic view-point. This decision was due in a considerable degree to the wide-spread feeling that our economic and social progress has lagged behind our technological development. The general topic of the Washington conference will be "National Power Economy," which will be discussed in relation to: Its physical and statistical basis; its technical, economic and social trends; the relation thereto of the fuel-producing, processing and distribution industries, and of electric and gas utilities; practices regulation; national and regional planning of power development and use; conservation of fuel and water resources; rationalization of the distribution of gas and electricity, and a national power and resources policy.

But the technical aspects of power production and utilization will by no means be neglected. The program of the second congress on large dams, to be held concurrently with the power conference, will be strictly technical, including a study of special cements; design and waterproofing of shrinkage, contraction and expansion joints; study of the facing of dams, dam foundations and earth dams in general. Besides the formal sessions of the World Power Conference there will be a supplemental technical program in connection with the study tours. A feature of these tours will be the "round table" discussions to be carefully planned in advance and led by experts, dealing with special technical problems pertinent to the places visited or of special interest to the respective groups of delegates.

The plan of paper presentation is to have each participating country submit one or more papers on each of the topics with which it has any concern. These papers will be condensed into reports to be presented by official reporters, to be followed by open discussion.

There will be a comprehensive exhibit to illustrate the latest developments in power production and utilization, so prepared as to interest both technician and layman. Photographs, models both operating and stationary, moving pictures and transparencies will be used.

The tours connected with the conference, as now

planned, consist first of a group of "study tours," each to last from 5 days to 2 weeks, to be scheduled both before and after the conference in accordance with the preferences of delegates. These "study tours" will be laid out according to major special technical interests of delegates. They will cover practically everything that can be seen in the way of power production, transmission and utilization east of the Mississippi. Second, a three week's post-conference trans-continental tour by special train is being planned to include Glacier Park, the Grand Coulee, Seattle, San Francisco and Boulder Dam.

The World Power Conference acts through national committees or representatives of some 50 nations. The national committees are made up in general of representatives of the governments of those countries, of the technical societies, of their educational institutions and of trade groups interested in power.

Plenary conferences are held every six years; the first was in London in 1924, the second in Berlin in 1930. At intervals there are sectional regional conferences for the discussion of specific problems.

Between conferences the permanent International Executive Council—of which Sir Harold Hartley, of Great Britain, is now chairman—holds annual meetings planning for future conferences and disposing of matters brought up at past conferences, the latter generally of a technical nature. There is a permanent headquarters in London.

An international Commission on Large Dams was organized on French initiative in 1930 as part of the World Power Conference; G. Mercier, of France, is chairman.

AWARD OF THE MEYER MEDAL TO P. H. DORSETT

THE Meyer Medal for distinguished service in plant introduction was presented on June 13 to P. H. Dorsett, who for over forty-five years has been associated with the scientific work of the U. S. Department of Agriculture. The presentation was made by Dr. David Fairchild, on behalf of the council of the American Genetic Association, at the Plant Introduction Station of the U. S. Department of Agriculture at Bell, Maryland.

Mr. Dorsett's greatest contribution to American agriculture was made between 1924 and 1927, when he was instrumental in bringing together the largest collection of soybean varieties that has ever been made. Two expeditions to China were undertaken to make this collection. On the first trip Mr. Dorsett and his son, the late James Dorsett, collected over 2,000 samples from Nanking and vicinity. On the second expedition, Mr. Dorsett and Dr. William J. Morse, soybean expert of the U. S. Department of

Agriculture, collected over 6,000 samples which were sent to the United States for test. A total number of over 2,000 distinct varieties of soybeans was obtained from these samples. These are being tested in many places to determine their value to the American farmer. Some of them are already being widely used.

Mr. Dorsett also took part in three expeditions to obtain new varieties of plants to Brazil (1913-14) and to the West Indies in 1927-30. He was instrumental in bringing into the United States valuable citrus varieties and many rare ornamental plants which are now being tested in the plant introduction station of the U. S. Government. He has also spent many years engaged in research in methods of utilizing plant introductions in American agriculture.

The Meyer Medal is awarded at intervals by the council of the American Genetic Association for distinguished services in plant introduction. It is named in honor of the late Frank Meyer, pioneer plant explorer of the U. S. Department of Agriculture, and had its origin in a fund left by him to his fellow workers in plant introduction, who voted to use it for this purpose. Mr. Meyer spent the last nine years of his life in plant explorations in China. He never returned from his last expedition, having been drowned on the Yangtze River in 1919.

THE SEMI-CENTENNIAL RESEARCH PRIZES OF SIGMA XI

THE Sigma Xi Semi-Centennial Research Prizes of one thousand dollars each have been awarded for work in the biological sciences to Dr. Richard E. Shope, of the Rockefeller Institute for Medical Research, Princeton, N. J., and for work in the physical sciences to Professor I. I. Rabi, of Columbia University.

In presenting the prizes at the semi-centennial meeting of the society, which was held at Cornell University on June 19 and 20, Dr. William F. Durand, national president of Sigma Xi, said:

All the chapters and clubs of Sigma Xi were asked to name one candidate for each of these awards, and to accompany their nomination with a statement of the project upon which the candidate is at work, together with supporting letters from three prominent scientists who are acquainted with the candidate and with the importance of his project.

There was a total of 85 different candidates—43 for the physical sciences and 42 for the biological sciences. The committee held two conferences at which all members were present, and a sub-committee on the physical sciences, and a sub-committee on the biological sciences had several conferences each. The committee called into counsel numerous individuals other than the original sponsors of the candidates, regarding the ability of can-

didates and the importance of their work in their particular field.

This statement of the conditions under which these awards have been made will be a sufficient indication of the severity of the scrutiny under which the work of the two present recipients has passed and of the high order of merit which must have been put in evidence in order that they should have been selected from this wide field of choice.

And now it becomes my very pleasant duty to announce the award of the Sigma Xi Semi-Centennial Research Prize of one thousand dollars for work in the biological sciences to Dr. Richard E. Shope, of the Rockefeller Institute for Medical Research, Princeton, N. J., for the work he has done on the etiology of swine influenza—particularly for determining the dual nature of this disease, and thus establishing a principle which it is believed will have wide application in the control of infective diseases.

Dr. Shope was born in Des Moines, Ia., December 25, 1901. He received his M.D. degree at Iowa University in 1924. He was instructor in pharmacology and materia medica in the College of Medicine at the University of Ohio for one year, and has been at Rockefeller Institute

since 1925. His particular work has been in the field of animal pathology and filterable viruses.

Dr. Shope, it affords me very great pleasure, on behalf of Sigma Xi, to hand to you the substantial evidence of this award and to wish for you a long and fruitful life in the further pursuit of scientific research in your chosen field.

The Sigma Xi Semi-Centennial Research Prize of one thousand dollars for work in the physical sciences is awarded to Professor I. I. Rabi, of Columbia University, for work which he has done on molecular beams, and particularly on the magnetic moments of the proton and deuteron, and because of the promise that this work holds for the future.

Dr. Rabi was born in Rymanow, July 29, 1898. He received his Ph.D. at Columbia in 1927. He was a fellow in physics at Columbia for one year, and has been assistant professor of physics at Columbia since 1930. His specialty has been in magnetism and quantum mechanics, and particularly in molecular beams.

And now, Dr. Rabi, it affords me very great pleasure, on behalf of Sigma Xi, to hand to you the substantial evidence of this award and to wish for you, too, a long and fruitful life in the future pursuit of scientific research in your chosen field.

SCIENTIFIC NOTES AND NEWS

At the commencement exercises of Harvard University the doctorate of laws was conferred on Dr. Isaiah Bowman and the doctorate of science on Dr. Elmer Drew Merrill and on Dr. Frank Baldwin Jewett. The citations were as follows: Isaiah Bowman, president of the Johns Hopkins University—"A distinguished geographer who maps with a bold and steady hand the future of an illustrious university." Elmer Drew Merrill, professor of botany and administrator of botanical collections at Harvard University—"A botanist famed for his investigations of the flora of the Philippines, an administrator marked by his effectiveness in many posts." Frank Baldwin Jewett, electrical engineer, president of the Bell Telephone Laboratories since 1925—"The creator of a famous laboratory whence came miracles of modern telephony, an engineer who points the way for industry to follow."

In presenting Dr. E. P. Hubble for the degree of doctor of science at Princeton University, Dr. Luther P. Eisenhart, dean of the Graduate School, made the following citation: "Edwin Powell Hubble, staff member of the Mount Wilson Observatory; graduate of the University of Chicago and of Oxford, as a Rhodes scholar; member of the National Academy of Sciences and Astronomical Societies in this country and abroad; by an extensive, well-planned campaign of observation and unusual insight in interpretation he

has supplied the first real understanding of the nature of the nebulae, showing that the diffuse nebulae are clouds of dust or gas in our galaxy, and that the spiral and elliptical white nebulae are swarms of stars, external to our galaxy, receding with enormous velocities and millions of light years distant; a Ulysses embarked with his telescope upon a great adventure in our expanding universe, seeking knowledge 'beyond the utmost bound of human thought.'"

DR. THOMAS BARBOUR, director of the Museum of Comparative Zoology of Harvard University, received on June 15 the honorary degree of doctor of science from Dartmouth College.

COLBY COLLEGE conferred on June 15 the honorary degree of doctor of laws, posthumously, on the late John Hays Hammond, mining engineer. Dr. Hammond, who died on June 8, was to have been a speaker at the one hundred and fifteenth commencement dinner.

THE honorary doctorate of laws was conferred on June 3 by the University of Toronto on Dr. George F. Kay, who for twenty years has been dean of the College of Liberal Arts of the State University of Iowa and who for more than twenty years was head of the department of geology and director of the Iowa Geological Survey. Dr. Kay graduated from the University of Toronto in the year 1900.

At Lehigh University two honorary degrees were conferred. The recipients were Stephen Timoshenko, professor of engineering mechanics at the University of Michigan, and Alexander Potter, consulting engineer, of New York City.

THE degree of doctor of science was conferred on June 24 by the University of Oxford on Dr. Edgar Douglas Adrian, fellow of Trinity College, Cambridge, Foulerton professor of the Royal Society, London.

Nature reports that at a recent meeting of the Quekett Microscopical Club, Sir David Prain was elected an honorary member. Sir David was director of the Botanical Survey of India and superintendent of the Royal Botanic Gardens, Calcutta, from 1896 to 1905 and director of the Royal Botanic Gardens, Kew, from 1905 to 1922.

DR. SIMON FLEXNER, member emeritus of the Rockefeller Institute for Medical Research, was elected an honorary fellow of the Royal Society of Medicine at the meeting held in London on May 19.

DR. ROGER JOHN WILLIAMS, professor of chemistry at Oregon State College, in recognition of his work on vitamins has been presented with the scroll given annually by the University of Oregon Chapter of Sigma Xi to an "outstanding man of science in Oregon."

RALPH W. HAYES, head of the Department of Forestry of the Louisiana State University, was elected president of the Gulf States Foresters at the recent meeting of the association in Bogalusa. A. D. Folweiler, also of the Louisiana State University, was named secretary-treasurer and L. L. Bishop, of Texas, vice-chairman.

HOWARD W. BLAKESLEE, science editor of the Associated Press, has been elected president of the National Association of Science Writers.

THE officers, executive committee and members of the Division of Geology and Geography of the National Research Council, for the year beginning July 1, are as follows: *Chairman*, Edson S. Bastin; *Vice-chairman*, Robert S. Platt; *Executive Committee*, Edson S. Bastin, Robert S. Platt, Donald C. Barton, Florence Bascom, F. H. Lahee and Frank E. Williams; *Representatives of Societies*, Donald C. Barton and A. F. Buddington, Geological Society of America; J. F. Schairer, Mineralogical Society of America; Charles Butts, Paleontological Society; Robert S. Platt and Frank E. Williams, Association of American Geographers; John K. Wright, American Geographical Society; Thomas B. Nolan, Society of Economic Geologists; F. H. Lahee, American Association of Petroleum Geologists; *Members at large*, Florence Bascom, Edson S. Bastin and L. F. Thomas.

DR. FREDERIC WILLIAM SIMONDS, professor of geology at the University of Texas, will retire from active full-time service at the end of the present school year. He will continue his work at the University of Texas on a part-time basis under the provisions of the retirement plan recently adopted by the Board of Regents. Dr. Simonds served on the faculties of Cornell University, the University of North Carolina and the University of Arkansas before going to the University of Texas in 1890. During his forty-six years of service in the department of geology at the University of Texas his chief interest has been the physiography of Texas and the Southwest.

DR. W. MCKIM MARRIOTT, dean of the Washington University School of Medicine since 1923 and professor of pediatrics, has been appointed dean of the Medical School of the University of California. He will also hold a newly established chair of research medicine. As dean he succeeds Dr. R. L. Porter, who is retiring. Temporarily the administration of the medical school of Washington University will be in the hands of a committee of which Dr. David P. Barr, professor of internal medicine, is chairman, and which includes Dr. Evarts A. Graham, head of the department of surgery, and Dr. Philip A. Shaffer, head of the department of biochemistry.

DR. JULIAN D. CORRINGTON, head of the educational service department of the Ward Natural Science Establishment, Rochester, formerly of the faculty of Drew University, has been appointed professor of biology at Washington College, Chestertown, Md.

DR. DAVID HARKER, of the California Institute of Technology, has been appointed instructor in charge of the first-year course in chemistry at the Johns Hopkins University.

DR. M. L. OLIPHANT, of the Cavendish Laboratory, the University of Cambridge, has been appointed to the Poynting chair of physics at the University of Birmingham, which will become vacant next September, owing to the retirement of Professor S. W. Johnson Smith.

Museum News states that Frederick Chapman, of the National Museum, Melbourne, has retired from the post of commonwealth paleontologist and has been succeeded in that office by Miss J. Crespín.

DAVID STURROCK, of Lanark, Scotland, formerly director of the Hershey Agricultural School, Cuba, has been appointed superintendent of the Atkins Institution of the Arnold Arboretum at Soledad, Cuba. He will succeed Robert M. Grey, who has resigned after thirty years of service to the institution, including ten years as superintendent.

DR. H. GARLAND HERSHEY, for five years a member of the Maryland Geological Survey, has been appointed assistant to the state geologist of Iowa.

DR. D. G. CATCHESIDE, lecturer in the department of botany at King's College, University of London, has been awarded a Rockefeller fellowship for research in cytogenetics. He will spend the year, beginning in September, working in Professor T. H. Morgan's Laboratory at the California Institute of Technology.

THE Committee on Scientific Research of the American Medical Association has renewed for one year a grant to Dr. J. R. Murlin for further study of the effects of male hormones on metabolism. A grant also has been made to Dr. Isaac Schour, of the University of Illinois College of Dentistry, to aid in his investigation on the rôle of the parathyroids in calcium metabolism.

PROFESSORS C. L. TURNER and Orlando Park, of the department of zoology of Northwestern University, are spending the summer at the Barro Colorado Station, Panama. Dr. W. R. Duryee has been spending the current year in European laboratories.

THE third Denver-Wyoming Expedition, directed by Dr. E. B. Renaud, of the University of Denver, left on June 15 to continue the archeological survey of the High Western Plains. Proceeding north and south, the expedition will explore the basin of the Green River, Black's Fork and tributaries. Dr. Renaud expects to make a collection of paleolithic implements.

DR. T. H. PEAR, professor of psychology at the University of Manchester, has been appointed the Riddell Memorial lecturer at the University of Durham for the academic year 1936-37.

DR. HARLAN T. STETSON, of Harvard University, addressed a joint meeting of the American Institute of Radio Engineers and the Radio Club of America at the Museum of Natural History in New York on June 3. The subject was "Cosmic Cycles and Radio Transmission."

DR. RAYMOND PEARL, professor of biology at the Johns Hopkins University, addressed the Medical Section of the American Life Convention at its annual meeting in White Sulphur Springs, W. Va., on June 11 on "Constitutional Factors in Diseases of the Cardio-vascular-renal System."

THE eleventh International Congress of Psychology, which was to have met in Madrid in September, has been postponed for a year.

THE seventh International Congress of Genetics will be held during the second half of August, 1937, in Moscow. Members of the organization committee are as follows: *President*, A. I. Muralov, president of

the Lenin Academy of Sciences; *Vice-presidents*, N. I. Vavilov, vice-president of the Lenin Academy of Sciences, and V. L. Komarov, vice-president of the Academy of Sciences; *General Secretary*, S. G. Levit; *Other members*, N. P. Gorbunov, G. D. Karpachenko, B. A. Keller, N. K. Koltzoff, T. D. Lysenko, G. K. Meister, H. J. Muller, M. S. Navashin and A. S. Serebrovsky. All those wishing to receive announcements in regard to the congress should send their names to the Organization Committee of the Seventh International Congress of Genetics, Institute of Genetics, Academy of Sciences, Bolshaya Kaluzhskaya 75, Moscow, USSR.

THE first International Conference on Fever Therapy, originally scheduled for the end of September, has been postponed because of numerous requests, to permit more time for the preparation of material. The new dates set for this conference are from March 30 to April 2, 1937. The sessions will be held at the College of Physicians and Surgeons, Columbia University, New York City. Invitations on behalf of the conference will be issued by the state department to ministries of public health of other countries. The medical departments of the Army, the Navy and the Public Health Service will be represented, as will also the New York City Departments of Health and of Hospitals. A tour has been arranged to take place immediately following the conference, to enable physicians to observe the techniques employed in fever therapy in some of the hospitals in the eastern section of the United States. Further information may be obtained from the general secretary, Dr. William Bierman, 471 Park Avenue, New York City, U. S. A.

THE scientific meetings of the second session of the eleventh annual meeting of the Hawaiian Academy of Science were held at the University of Hawaii on May 14 and 15. Fourteen papers were presented, including an invitation paper entitled "Stock-taking in Ethnology," by Dr. Peter H. Buck, recently appointed director of the Bernice P. Bishop Museum. The annual banquet was held at the Pacific Club on the evening of May 16. This was followed by the annual business meeting. The address by the retiring president, Dr. Chester K. Wentworth, was entitled "Modern Bench-forming Processes on Oahu Shores." The following officers were elected for 1936-37: *President*, Dr. Harold A. Wadsworth (soil physics), University of Hawaii; *Vice-president*, Dr. Walter Carter (entomology), Experiment Station, Pineapple Producers' Cooperative Association; *Secretary-Treasurer*, Miss Mabel Slattery, Queen's Hospital; *Councilor for two years*, Dr. Oscar C. Magistad (chemistry), Hawaii Agricultural Experiment Station; *Councilor for one year* (hold-over), Edward Caum (botany), Experi-

ment Station, Hawaiian Sugar Planters' Association, and *Councilor-ex-officio*, Dr. Chester K. Wentworth (geology), Board of Water Supply.

A CANCER INSTITUTE will be held at the Medical School of the University of Wisconsin, under the auspices of the Alumni Research Foundation, from September 7 to 9, inclusive. The general outline of the program, which will be available upon inquiry after July 1, follows: I. *Etiology of Cancer*. (A) Intrinsic Factors: Drs. Kreyberg, Oslo; Little, Bar Harbor, Me., and Macklin, London, Ont. (B) Extrinsic Factors: Drs. Allen, Columbia, Mo.; Ander-vont, Boston, and Murphy, New York City. II. *Cytology*. Drs. Ewing, New York City; Lewis, Baltimore, and Reimann, Philadelphia. III. *Irradiation*. Drs. Coutard, Paris, and Failla, New York City. IV. *Surgery*. Dr. Novak, Baltimore.

THIRTY exceptional students, selected from thirteen Canadian universities, have been awarded postgraduate scholarships for the year 1936-37 by the National Research Council at Ottawa. The policy of assisting exceptional students to pursue postgraduate work in Canadian universities has been followed since the inception of the council, the object being to build up in Canada a supply of well-trained scientific men capable of undertaking and carrying through any research investigations required in the promotion and development of industrial processes looking to the better or more profitable utilization of Canadian raw materials and the expansion of markets for Canadian products. Awards are of three classes: bursaries, \$500; studentships, \$600; fellowships, \$700. The council has announced that the grants this year include two fellowships, eleven studentships and seventeen bursaries.

DISCUSSION

SUBMERGED VALLEYS ON CONTINENTAL SLOPES AND CHANGES OF SEA LEVEL

IN an article with the above title Hess and MacClintock proposed a new explanation for submarine canyons.¹ They suggested that there was a sudden change in the shape of the hydrosphere which depressed sea level in low latitudes and raised it in high latitudes and that this was followed by a reshaping of the lithosphere which brought the sea level back to normal. As a cause for such shifts they suggested, somewhat hesitantly, that there might have been a sudden change in the rate of rotation of the earth.

Probably astronomers will agree with Professor Russell (as quoted by Hess and MacClintock) that a sudden change in the rate of rotation is almost out of the question, but it is worth considering what would happen if some unknown force did suddenly decrease the rate of rotation. The hydrosphere would, of course, react first and send the water to the polar regions and away from the equator. There would be neutral lines in between, along which there would be no change in level. These would appear at about 35° north and south latitude.² The canyons would be cut at depths increasing from zero at the neutral lines to a maximum at the equator. Hess and MacClintock state that the facts available are compatible with the hypothesis, but they state also that canyons are found off Newfoundland, Vancouver Island and Ireland, all in latitudes well north of this neutral line.

While these authors have (as just shown) disproved their own contention there are some aspects of their arguments which need further consideration. The

statement that canyons grow shallower going away from the equator is certainly a surprise to one who is familiar with the soundings of the canyons in various parts of the world. It is quite true that soundings have not revealed canyons off the Arctic coasts as yet, but this might be explained by the scarcity of soundings in those areas and might also be due to the presence of ice caps in the Arctic during the canyon-cutting episode. Canyons are found, however, at 55° latitude in Bering Sea and perhaps farther north. The deepest thoroughly authentic canyons are located around 34 to 40 degrees of latitude, including the deep canyons off California, Japan and Portugal. Hess and MacClintock based their statement of the tracing of a canyon to 14,000 feet below sea level on a survey which would not be considered adequate to any one familiar with the hydrographic work.³ From older, more reliable soundings it seems not unlikely that the deep depressions of the Bahamas are fault troughs.

Hess and MacClintock make another statement which requires discussion. They refer to my tentative suggestion that the canyons were the result of locking of sea water in glaciers formed in polar regions, stating that the idea is impossible, since the ice would have to reach a thickness of 50,000 feet. This statement shows unfamiliarity with the idea so summarily dismissed. I have never claimed that the canyons owed their greatest depths to glacial lowering of sea level, but I have suggested that lowering of several thousand feet could have been produced by polar ice caps. For a

³ In 1932 the U. S. Navy kindly loaned the use of a submarine and tender for gravity work in the West Indies. Unfortunately the only vessels available were not equipped with adequate echo-sounding machines. As a result, while the gravity work constituted a notable contribution, the soundings were clearly unreliable.

¹ SCIENCE, April 3, 1936, p. 332.

² This figure was supplied by Dr. H. R. Brahma and its correctness is affirmed by Dr. H. N. Russell.

necessary thickness for these caps I have estimated 30,000 feet, which is by no means out of the question, both in view of the thickness of the present Greenland cap and of the necessary thickness of a cap which covered Mt. Washington near its outer margin. In the near future I expect to publish considerable evidence in support of the glacial lowering as one of the factors in the production of canyons.

The paper by Hess and MacClintock represents an unfortunate tendency among scientists to jump hastily to conclusions without a careful examination of the facts of the case. New suggestions of this sort are often valuable and frequently should be set forth without too much delay, but if the authors do not have time to check the factual basis for their ideas should they not at least consult some one who is familiar with the subject?

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STELLAR DISTANCES AND THE EXPANDING UNIVERSE

I WOULD draw attention to a fallacy in the fashionable concept of an "expanding universe"; linked as it is to the older and even more widely held illusion as to stellar distances—errors due to faulty thinking.

For we can not tell the present position of any star or nebula. And thus can not tell their distances from each other or from us. So that through lack of any possible spatial relations—of expansion, contraction or relative motions of any kind—all talk of the "expansion" of the "island universes" system of nebulae, each with a "light-years" value differing by many millions of years, is folly. The "red-shift," that we tentatively interpret as a swift recession from us of this nebula at so many kilometers a second so many million years ago, and of that other at so many more kilometers a second so many more million years ago, lacks the "whole" in a common time-setting that would make such an expansion intelligible.

Obviously, a thing must exist, or be in time, before it can occupy any place in space. And thus two or more things must be contemporaneous, or coexist in the same instant, before there can be any spatial relation in that instant between them. An imaginary triangle, say, connecting the earth with two stars—one, say, 60 light-years away and the other 100—is wholly fictitious, since its three apices—the earth and the two stars—are given us in widely separated time-settings. A man in a Chevrolet motor car was driving eastward from 18th to 17th Streets, along Pennsylvania Avenue in Washington, D. C., at forty miles an hour at 10:30 A. M. of the forenoon of January 30, 1936, and another man was similarly driving a Ford westward along the same section, from 17th to 18th, at 30 miles

an hour at 4 P. M. of the afternoon of August 10, 1913. How swiftly are the two cars approaching? The question is obviously meaningless. The two cars are not approaching, nor in any way spatially related, for they are not in the same time-setting.

Again, taking the distance from 17th to 18th as, say, 900 feet, you were standing, at noon of March 15, 1936, on that same section of Pennsylvania Avenue, 300 feet from the 18th Street crossing, and thus 600 feet from the 17th one. You know precisely how far you are from where the two cars were, six weeks, and 23 years previously, corresponding exactly to the "light-years" determinations for various stars. But it would be folly to assert that you were therefore 300 and 600 feet, respectively, from the two cars; or that those cars were 900 feet apart; either now, or six weeks, or 23 years ago. Quite similarly we can calculate that, say, 100 years ago a certain star was blazing at a point 100 light-years distant (or the equivalent number of miles or kilometers) from where we are now. But it is impossible to interpret this as meaning that we are that number of miles or kilometers from the said star; either now, from the point where we are at present, or 100 years ago from the unknown point where we then were.

If the heavens were static it would be permissible. But, unfortunately for our purpose, the stars and nebulae are all traveling at dizzy speeds along unknown and unpredictable paths; and each in a different direction, whereof we can merely deduce the radial component at some long past instant.

Were we to limit ourselves to our "home grounds"—the solar system—we can, in that simple "frame of reference," approximately plot, with no great difficulty, the elliptical paths of our planetary family, and thus determine our rapidly varying several positions at any given common instant, so that our distances from each other, and from our sun, can have a real meaning. But when we pass to the starry heavens as a whole, with our solar system as itself a star, all sweeping with terrific velocities along their several complicated and compounded unknown paths, there is no longer any possibility of our being able to evaluate relative positions, at some common instant, for lapsed hundreds, thousands and even millions of years. And yet unless we could, in this manner, or some other, secure relative positions at the same moment, all talk of distances is meaningless, and the popular statements as to the distances of stars and nebulae, the size of the galaxy, and especially the "expansion of the universe" as a whole, are foolish.

We can trace the origin of the blunder to the quite human error of wrongfully applying in the heavens concepts that are quite valid in the widely different terrestrial sphere. For from the dawn of life until

now, and from our earliest infancy to this moment, a constant and invariable earthly experience has driven into our subconsciousness the conviction that light is instantaneous, and that what we see now, exists now—an assumption that is pragmatically correct and that works in our daily life, but which is thoroughly false and misleading when we consider the stars and nebulae. As physicists our educated brains accept the fact that light has an exact, though still high, finite velocity, which, while still practically instantaneous in our daily lives, yet becomes of paramount importance in the vast abysses of space. Furthermore, in any earthly landscape not only are the time differences between the farthest and the nearest objects inappreciable, but our vision occupies some little time; certainly several seconds, being composed of perhaps 5 per cent. visual impressions and 95 per cent. our interpretations thereof through experience. Our ordinary seeing, then, is never momentary; but deals with a broad band of contemporary events; homogeneously blended from all parts of our landscape, which we therefore view as a legitimate whole and can validly determine distances and relative movements.

But in considering the stars and nebulae, their vast time differences totally exclude any possibility of such an overlapping and unifying band of the "same time." And thus we are completely barred from stating anything as to their positions, distances or relative movements. And certainly have not the contemporaneous "whole" that the hypothesis of an "expanding universe" would demand.

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FLOODS AND DUST STORMS

UNDER "Science News" in the March 27, 1936, issue of SCIENCE, Paul B. Sears attributes floods and dust storms to the removal of the top layer, or "A-horizon," of the soil, indiscriminately applying his thesis to the floods which have just ravaged the North Atlantic states. It is unfortunate that Dr. Sears has tried to inject the important question of soil preservation into a situation where it has absolutely no application, for this type of indiscriminating enthusiasm merely befores the flood problems which confront the north-eastern section of the country and invites unwarranted suspicion of the demand for soil preservation.

Dr. Sears may have traveled in one of the oldest farming sections of the East, but it is obvious that he knows little concerning New England. During my twelve years of residence in New England, there have been two major floods; one in November, 1927, the other in March, 1936. Both affected regions in which there is more woodland than farm country, and where spongy vegetation and top-soil have maximum absorptive capacity. In 1927 seven inches of rain fell upon

soil covered by a mat of leaves and already saturated by the abnormally high precipitation of a wet summer and fall. A saturated sponge can hold no more water. In 1936, there were four inches and more of rain upon one to four feet of rapidly melting snow, with a deeply frozen top-soil beneath. A frozen sponge can hold no water.

As an observer of floods from Canada to the Tropics and of dust storms from the Connecticut Valley to California, I find Dr. Sears's viewpoint that soil preservation will solve the problems connected with both much too elementary; and government agencies for flood control are not going to get very far unless they see the problems whole and tackle them along the whole of a very complicated front. Surely Dr. Sears knows that there were deserts on the march before the white man farmed the prairie—witness the loess; and that there were floods on the rampage before mammals discovered the flood-formed Great Plains.

Much as we may applaud the eloquent and, it is to be hoped, effective effort he is making to save our greatest economic asset, the soils, one must deplore a lack of discrimination or penetration, which may at once undermine public confidence in his own thesis and nullify the equally legitimate efforts of those who are approaching flood-control from a different but fully as valid standpoint.

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AN EXPLANATION OF ADRENALIN ACTION

A FURTHER study of the K action, as described by McGuigan and Higgins,¹ has led us to conclude that most of the changes effected by adrenalin are actually produced by K. The following facts are offered to substantiate this conclusion. Adrenalin effects an increase in serum K.^{2,3} K salts injected intravenously effect changes identical with those produced by adrenalin. This is true not only as far as the cardiovascular system is concerned but also on the intestinal tract, urinary bladder, kidney, bronchiole muscles. Cocaine does not potentiate with K. The action occurs after removal of the adrenal glands. K also effects a fleeting hyperglycemia, but if a large amount of K is present sugar readings are low. Relatively large amounts of K added to a known sugar solution decrease the readings. A complete analysis of this subject is in preparation for publication.

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¹ McGuigan and Higgins, *Amer. Jour. Physiol.*, 114: 207, 1935.

² De Silva, *Jour. Physiol.*, 82: 393, 1934.

³ Schwartz, *Arch. f. Exp. Path. u. Pharmacol.*, 17: 628, 1935.

SCIENTIFIC BOOKS

OCEANIC BIRDS OF SOUTH AMERICA

Oceanic Birds of South America. A study of species of the related coasts and seas, including the American quadrant of Antarctica based upon the Brewster-Sanford collection in the American Museum of Natural History. By ROBERT CUSHMAN MURPHY. 8vo., Vol. 1, pp. xxiv + 640; Vol. 2, pp. 641-1245, 15 col. and 72 black and white pls., 80 text-figs., American Museum of Natural History, New York, 1936.

To most ornithologists the birds of the sea are much less familiar than those of the land; their life in open spaces often precludes a close approach, while their nesting places may be remote and difficult of access. Dr. Murphy's two splendid volumes on the oceanic birds of South America are therefore doubly welcome, for they bring together in compact form a vast amount of data, gathered from every available source, reviewed critically in the light of the author's rich experience, both in the field and in the study of museum specimens.

Birds that are closely associated with the sea fall roughly into four ecological groups: (1) the littoral birds that frequent beaches and rocky foreshores, such as oystercatchers, kelp geese, sheathbills; (2) inshore birds, confined to waters mostly within sight of land, such as many gulls and terns; (3) offshore birds that range "on soundings," or roughly to the edge of the continental shelf, such as cormorants, pelicans and some of the diving petrels; and (4) pelagic birds of the open sea, such as many petrels, shearwaters and albatrosses, tropic birds and migratory penguins. The last group is especially abundant in the southern oceans. Many of them spend much of their lives at sea, reducing to a minimum the time spent on land for nesting. Such a life is one of high specialization, for the bird must be able to cover wide spaces, to rest on the surface amid tossing waves, to find sustenance from the waters, to drink salt water, to ride high gales with ease and safety and to find its ancestral breeding ground on some remote islet with unfailing accuracy at proper times.

The first volume reviews the field work carried on over many years by various collectors, whereby the great series of South American seabirds in the American Museum of Natural History has been built up. Outstanding among these is Rollo H. Beck, whose energy and skill in securing and preparing such specimens is in large measure responsible for the acquisition of the material needed in comparative study. In earlier days many pelagic species were first made known from occasional specimens taken as chance offerings at sea. These afforded little or no basis for precise knowledge of variation, whether individual,

sexual, seasonal or geographical. Even the breeding grounds of many were unknown until more recent years. Gradually, however, collections have been built up, enabling the close comparison of related forms from various breeding stations, so that in many cases differences previously unexplained take on a meaning. Nevertheless, "no single museum in the world possesses an even moderately good representation of birds from the antarctic and subantarctic islands as a whole." Some three hundred pages are devoted to an account of ocean currents, winds, and temperatures of both land and sea, considered especially in their effect on the bird life. It is shown that surface temperature of the water is a major control of distribution, primarily as it affects the food supply. The cooler waters about southern South America and Antarctica are relatively rich in diatoms, which in turn support vast multitudes of small crustaceans. These again afford sustenance directly to many seabirds, seals and whales, or indirectly through making possible an abundance of fish or cephalopods which may be utilized as food for still greater numbers of birds. Ocean currents of markedly different temperatures do not readily mix, and differ greatly in their potentiality for supporting minute forms of life. Consequently, there may be relatively sharp though invisible boundaries delimiting the distribution of these organisms, and as a result the ranges of the seabirds dependent upon them are similarly marked off.

A striking example of such an effect is the Humboldt Current, which carries cold water northward along the west coast of South America to tropical latitudes. Its temperature and chemical content are favorable for the growth of diatoms, crustaceans, fish and consequently higher forms of life. Its diversion westward off the coasts of Peru and Ecuador makes possible the presence of a penguin and a sea lion in the Galapagos group, southern types which otherwise could hardly live under tropical conditions. To the northeast, a smaller current of warm, tropical water, "El Niño," passing southwestward meets the Humboldt Current, and is of particular interest on account of the visible effects it sometimes causes when by unusual fluctuation it invades the cooler waters, killing myriads of fishes and causing death to seabirds. Winds, especially the steady-blowing trades in mid-latitudes or the strong westerlies of the southern ocean, are less a factor in accounting for avian distribution, although no doubt they are a necessity for the larger soaring birds. Tropical hurricanes play a minor part, though often accounting for waifs that may be carried far from their normal habitat. The author suggests the attractive view that oceanic birds tend to fight the wind only when they are carried to lee shores, hence they begin to tire only at such times; further, birds

caught in the calm "eye" of a hurricane are carried out of normal bounds not so much by the force of the wind as by their constant avoidance of the stronger air currents, so that they are constantly turned back toward the quieter center of a cyclonic storm and thus inevitably are carried along in its track.

An interesting feature is an imaginary journey in which the reader is taken completely around South America, visiting each of the isolated rocks and island groups as far east as Ascension and Gough Island, south to the Falklands and South Georgia and west to the Galapagos. Each of these is described and its seabirds are listed while the accompanying maps, inserted as text-figures, show very clearly the outlines and something of the topography of these important nesting areas.

The major part of the work is devoted to a detailed account of the many seabirds, 183 species and subspecies in all, that occur in the South American sector. These include members of sixteen families, representing five orders (the penguins, petrels and albatrosses, the pelicans and their allies, sundry shorebirds and ducks). The nomenclature of each species is reviewed, its plumages are described, and the known facts relative to its distribution and habits are given. A vast amount of data published and unpublished is critically sifted and set forth in detail. Many of these life histories are exceedingly interesting and afford for the first time a fairly complete picture of the birds' activities. The account of the wandering albatross is a good example. Published errors as to the wing spread are corrected; it is to be not 17 feet, as given by one authority, but instead not over 11.5 feet. The extraordinary habit of the parents in deserting their young before it can fly is shown to be quite normal, for the young bird lives for the last three months of its nestling life entirely without food, depending on the great accumulation of fat gained in the five preceding months while it was being actively fed. The

young do not leave the nest until they are nearly a year old.

Two new forms are described: the Fuegian petrel, *Oceanites oceanicus chilensis*, which migrates northward into the Pacific Ocean in the non-breeding season, and a small race of cormorant, *Phalacrocorax olivaceus hornensis*, from Bertrand Island, Chile. With a sufficient series of skins, Dr. Murphy appears to have solved the puzzling status of the steamer ducks and shows that instead of one species with volant and non-volant forms, there are in fact three: namely, a flightless form in the Falkland Islands, *Tachyeres brachypterus*; a different flightless bird, *T. ptenere*, inhabiting the continental region from Cape Horn and the Magellanic coasts to Chiloé; and finally a flying species, *T. patachonicus*, inhabiting the entire area covered by the ranges of the two first. Incidentally it may be pointed out that the flightless cormorant (*Nannopterum*) of the Galapagos group is represented by such small numbers that its existence is likely to become precarious, although a saving factor is that it forms only small breeding colonies easily overlooked by visitors.

Altogether this is an outstanding piece of work carefully done, summarizing the present state of our knowledge of these seabirds and affording a firm basis for any further work in the future. A captious critic might feel that in parts there is even too much detail and it might have been helpful in finding particular data if side headings had been more freely used. Sixteen colored plates by Jaques help the reader to visualize the settings among which the birds live, but the figures are perhaps too small to do more. Most of the species are further illustrated by a wealth of photographs taken in part by the author. An excellent bibliography and a full index complete this most attractive work.

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SPECIAL ARTICLES

THE DETERMINATION OF ACIDITY IN HEAVY WATER MIXTURES

WITH the increasing use of deuterium oxide as a research tool in biological chemistry, it becomes important to develop methods for the precise determination of acidity in that solvent and its intermediate mixtures with light water. Ultimately, the colorimetric method will probably receive the most general application by virtue of the ease and rapidity of the technique and the small amounts of material required. However, the quantitative interpretation of colorimetric measurements requires a knowledge of the influence of deuterium substitution upon the ion-product of the solvent as well as the dissociation constants of the acid-base systems employed as buffers

and as indicators—data which can best be obtained by e.m.f. methods.

The e.m.f. measurements available at present indicate that¹ K_w is decreased 6.13 fold at 25° C.; i.e., $C_D \cdot C_{OD} = 0.16 \times 10^{-14}$ and that the dependence upon deuterium content in mixtures of H_2O-D_2O is not linear. This means that if one wishes to construct a pD^+ scale analogous to a pH^+ scale, the characteristic points 0, 7 and 14, referring to molal hydrogen-ion activity, hypothetical neutrality and molal hydroxyl-ion activity, respectively, become 0, 7.4 and 14.8 for molal deuterium-ion activity, neutrality and molal deuteroxyl-ion activity, when pure D_2O is the solvent.

¹ Abel, Bratu and Redlich, *Zeits. f. physik. Chem.* A173: 353, 1935.

Investigations in progress in this laboratory and elsewhere have revealed that deuterium substitution exercises a more pronounced influence upon the chemical properties of acid-base catalysis and acid dissociation constants than might have been predicted on the basis of the changes in physical properties investigated soon after the discovery of deuterium. For example, the ratio of the viscosities of light and heavy water, which exhibits the largest change of any purely physical property, is only 0.79. On the other hand, Table I shows that the effect upon chemical kinetics is much greater.

TABLE I

Property	Ratio $\frac{\text{in H}_2\text{O}}{\text{in D}_2\text{O}}$
Viscosity	0.79 ²
Velocity of nitramide decomposition	5.2 ³
Mutarotation of glucose	3.8 ⁴
Nitroethane neutralization	6.0 ⁵
Inversion of sucrose	0.47 ⁶

TABLE II

Acid	K_{HA}/K_{DA}	pK (in H ₂ O)	pK (in D ₂ O)	Observer
Water	6.13	14.0	14.8	A. B. and R.
Hydroquinone ($K = \sqrt{K_1K_2}$)	3.84	10.58	11.15	L. and K.
Acetic	3.32	4.75	5.27	L. and K.
Salicylic	4.1	3.00	3.61	L. and K.
Chloroacetic	2.7	2.8	3.2	L. and S. ⁸
NH ₄ ⁺ = NH ₃ + H ⁺	30.0	9.75	10.7	L. and S.
NH ₄ OH = NH ₄ ⁺ + OH ⁻	1.5	4.75	4.93	L. and S.

The same marked effect has been observed for acidic dissociation, where the ratios of the dissociation constants range between 3 and 6. We have found the

II lists the ratios for the acids which have been reported thus far, together with the corresponding pK values in H₂O and in D₂O.

The effect of deuterium substitution appears to be specific, although in general it is more pronounced for weaker acids.

The potential of the quinhydrone electrode in HCl and DCl solutions is 0.0345 volt more positive in D₂O than in H₂O. This difference arises from the unsymmetric distribution of deuterium in the exchange equilibrium $\text{QH}_2 + 2\text{DCl} = \text{QD}_2 + 2\text{HCl}$ corresponding to $K = 14.64$. Other exchange equilibrium constants are listed in Table III.⁹ It will be noted from No. III that the deuterium-ion concentration in aqueous solution is less than would be expected from its stoichiometric molality as a result of the unsymmetric character of the exchange. This generally unequal distribution of protium and deuterium ions is of fundamental importance in the interpretation of the kinetics of reactions in intermediate mixtures of H₂O and D₂O.^{6, 3}

The success of the quinhydrone electrode as a rapid and reliable means of determining hydrogen-ion activities in biological media where the quantities of material are often severely limited is well known. This electrode reaches a stable equilibrium quickly, and should prove to be as well adapted for biological investigations with heavy water and its intermediate mixtures, as it has for ordinary water. When employing the deuterium gas electrode for intermediate mixtures of H₂O-D₂O, one should recognize that the deuterium content of the gas phase (H₂-D₂) will differ very considerably from the deuterium content

TABLE III
EXCHANGE EQUILIBRIA IN SOLUTION

No.	Process	$E^\circ = (.059/n)\log K$	K	Observer
I	$2\text{DCl} + \text{QH}_2 = 2\text{HCl} + \text{QD}_2$	0.0345	14.64	L. & K.
II	$\text{QH}_2 + \text{D}_2\text{O} = \text{QD}_2 + \text{H}_2\text{O}$		0.96	H. & L.
III	$2\text{DCl} + \text{H}_2\text{O} = 2\text{HCl} + \text{D}_2\text{O}$ ($2\text{D}^+ + \text{H}_2\text{O} = 2\text{H}^+ + \text{D}_2\text{O}$)		15.3	I - II
IV	$2\text{DCl} + \text{H}_2(\text{g}) = 2\text{HCl} + \text{D}_2(\text{g})$.0034	1.30	A. B. & R.
V	$\text{D}_2(\text{g}) + \text{H}_2\text{O} = \text{H}_2(\text{g}) + \text{D}_2\text{O}$		11.8	III - IV
VI	$\text{QH}_2 + \text{D}_2(\text{g}) = \text{QD}_2 + \text{H}_2(\text{g})$		11.26	I - IV
VII	$2\text{H}_2\text{O} + \text{D}_2(\text{g}) + 2\text{NaOD} = 2\text{D}_2\text{O} + \text{H}_2(\text{g}) + 2\text{NaOH}$.0431	28.58	A. B. & R.
VIII	$\text{H}_2\text{O} + 2\text{NaOD} = \text{D}_2\text{O} + 2\text{NaOH}$		2.42	VII - V
IX	$\text{HCl} + \text{NaOD} = \text{DCl} + \text{NaOH}$		0.4	$\frac{1}{2}(\text{VIII} - \text{III})$
X	$2\text{NaOD} + \text{H}_2(\text{g}) = 2\text{NaOH} + \text{D}_2(\text{g})$		0.21	VII - 2V
XI	$\text{D}^+ + \text{OD}^- + \text{H}_2\text{O} = \text{H}^+ + \text{OH}^- + \text{D}_2\text{O}$.0233	6.13	$\frac{1}{2}(\text{VII} + \text{IV})$

quinhydrone electrode to be satisfactory for making such measurements. The dissociation constants obtained with this electrode in D₂O prove to be in very close agreement with the conductivity measurements of acetic acid solutions in H₂O-D₂O mixtures.⁷ Table

² Baker and La Mer, *Jour. Chem. Phys.*, 3: 406, 1935.

³ La Mer and Greenspan, unpublished results.

⁴ Hamill and La Mer, *Jour. Chem. Phys.*, 4: 294, 1936.

⁵ Wynne-Jones, *Jour. Chem. Phys.*, 2: 381, 1934.

⁶ Hamill and La Mer, *Jour. Chem. Phys.*, 4: 294, 1936.

⁷ Unpublished work of James P. Chittum in this laboratory.

⁸ G. N. Lewis and Schutz, *Jour. Am. Chem. Soc.*, 56: 1913, 1934. These data were obtained upon very small quantities of D₂O and may require revision.

of the liquid phase by virtue of No. V, Table III. This circumstance complicates the ready use of the gas electrode. On the other hand, the exchange equilibria between the proto- and deuterioforms of hydroquinone and the corresponding components of the solution are set up in a homogeneous system; hence the distribution of deuterium in the quinhydrone is automatically adjusted to the value corresponding to complete equilibrium with the solvent. The normal potential of the quinhydrone electrode exhibits a minimum value

⁹ Detailed account to appear in the *Journal of the American Chemical Society*.

(about 2 mv. less than for H_2O) at 5 per cent. D_2O . For higher D_2O content E° is an almost linear function of the composition of the solvent.

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THE INACTIVATION OF CRYSTALLINE TOBACCO-MOSAIC VIRUS PROTEIN

THE isolation of a crystalline protein possessing the properties of tobacco-mosaic virus has been described.¹ It has now been found that treatment of this active protein with hydrogen peroxide, formaldehyde, nitrous acid or ultra-violet light produces inactive native proteins that, although slightly altered, retain certain chemical and serological properties characteristic of the virus protein. These inactive proteins do not cause the mosaic disease nor the production of a high molecular weight protein on inoculation to Turkish tobacco plants, and do not produce local lesions on inoculation to *Nicotiana glutinosa* L.

Although the inactive proteins are native and may be taken into solution and crystallized, their solutions are more opalescent than are those of active protein, and they tend to denature more readily than does active protein. The optical rotation of solutions of protein previously treated with ultra-violet light, hydrogen peroxide or formaldehyde is practically unchanged, while solutions of protein inactivated by nitrous acid possess a considerably lower laevo rotation than before treatment. The isoelectric point of protein inactivated by ultra-violet light or by hydrogen peroxide is practically unchanged, while that of protein treated with formaldehyde or nitrous acid is shifted towards the acid side. The amino-nitrogen content of protein inactivated by means of hydrogen peroxide or formaldehyde is considerably lower than that of active protein, and, as would be expected, the protein treated with nitrous acid contains practically no amino-nitrogen. A preliminary determination of the sedimentation constant of protein inactivated by ultra-violet light, kindly made by Dr. Wyckoff and Mr. Biscoe, indicates that no marked change has occurred in the molecular weight; the more diffuse boundary they observe, however, is indicative of a decreased molecular homogeneity. Under the microscope the crystals of the inactive proteins are indistinguishable from those of active protein, and in a preliminary analysis of oxidized protein, kindly made by Drs. Wyckoff and Corey, no conspicuous difference in the x-ray diffraction pattern was found. Mixtures containing varying amounts of active and inactive protein may be prepared, crystallized and recrystallized. The crystals are indistinguishable from those

of active protein, but they possess an activity which is slightly less than that which would be proportional to the amount of active protein that they contain. Crystalline protein possessing any desired activity less than that of the regular active protein may be prepared by mixing the active and inactive or by partial inactivation of active protein using any of the four methods mentioned.

In a typical experiment, inactivation of a 1 per cent. solution of virus protein occurred after standing for 5 hours at 27° C. with 5 per cent. formaldehyde at pH 7, 5 per cent. hydrogen peroxide at pH 7, or with 2 per cent. sodium nitrite at pH 3. The amino-nitrogen content was found to have been decreased 60 per cent., 60 per cent. and 99 per cent., respectively, as a result of the treatments. Irradiation of a 0.5 per cent. solution with the full light of a laboratory mercury vapor lamp for 8 hours caused inactivation. The preparations were dialyzed against water at pH 7 immediately after the treatments and were then tested for virus activity.

The sera of animals injected with virus preparations give a precipitate when mixed with a solution containing as little as 10^{-5} gm per cc of inactive protein, and the serum of an animal injected with a solution of inactive protein gives a precipitate when mixed with solutions containing but 10^{-5} gm. per cc. of either active or inactive protein. Thus the precipitin reaction, which has been used as a measure of virus activity,² may not be used unreservedly for this purpose, for in the case of inactive protein there is no correlation between precipitin titer and virus activity. Positive precipitin reactions between anti-sera to virus preparations and apparently inactive material have been reported.³ The serum of an animal injected with protein inactivated by ultra-violet light has a neutralizing effect on tobacco-mosaic virus, which appears to be similar to that previously reported for the sera of animals injected with sap from mosaic-diseased plants.⁴

Vigorous treatment of the virus protein, such as denaturation by means of acids, alkalis or heat, oxidation with potassium permanganate, chromic acid or chloramine-T, or prolonged treatment with concentrated nitrous acid, causes not only loss of virus activity, but also loss of the characteristic properties of the protein, and it is only by means of comparatively mild treatments that inactive native protein, retaining

² T. Matsumoto and K. Somazawa, *Jour. Soc. Trop. Agr.*, 2: 223, 1930; *Ibid.*, 6: 671, 1934; J. M. Birkeland, *Bot. Gaz.*, 95: 419, 1934; K. Starr Chester, *Phytopath.*, 25: 702, 1935; E. T. C. Spooner and F. C. Bawden, *Brit. Jour. Exp. Path.*, 16: 218, 1935.

³ T. Matsumoto and K. Somazawa, *Jour. Soc. Trop. Agr.*, 3: 24, 1931; F. C. Bawden, *Brit. Jour. Exp. Path.*, 16: 435, 1935; F. C. Bawden and N. W. Pirie, *ibid.*, 17: 64, 1936.

⁴ Helen A. Purdy, *Jour. Exp. Med.*, 49: 919, 1929; Kenneth S. Chester, *Phytopath.*, 24: 1180, 1934.

¹ W. M. Stanley, *SCIENCE*, 81: 644, 1935; *Phytopath.*, 26: 305, 1936.

many of the characteristic chemical and serological properties of virus protein, may be obtained. As a whole, the preliminary results indicate that only slight changes occur in the protein molecule on inactivation by the four methods mentioned. Although there is always a possibility, as with any apparently pure substance, that the crystalline tobacco-mosaic virus protein may consist of two closely related components, one active and the other inactive, the available evidence indicates that the virus activity is a specific property of this high molecular weight protein. It appears likely, therefore, that the slight changes in the protein, which result from treatment with formaldehyde, hydrogen peroxide, nitrous acid or ultra-violet light, cause it to lose its ability to infect susceptible plants.

W. M. STANLEY

THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
PRINCETON, N. J.

SUPERIOR INFLUENCE OF THE MOTHER ON BODY SIZE IN RECIPROCAL HYBRIDS

In previous papers¹ it has been shown that in rabbits and in mice, when races of unlike body size are reciprocally crossed or reciprocally backcrossed, the maternal group of larger body size produces offspring of larger body size. In other words, the mother has greater influence than the father on the body size of the offspring. This might be supposed to be due either to cytoplasmic influence of the egg or to an influence exerted by the mother during gestation. The latter al-

ternative seems to be excluded in the case of some amphibian crosses recently described by Käte Pariser,² in which a similar difference is found between reciprocal crosses produced by subspecies of *Triton* of different body size, but in which the development of the young takes place outside the body of the mother. The crosses made by Pariser were studied primarily with reference to the sex ratio and problems of sex determination, but incidentally they throw light on size inheritance.

The superior influence of the mother is shown with especial clearness in the reciprocal crosses between *Triton palmatus* and *Triton alpestris*. The mean body lengths of metamorphosed individuals of the respective parent species are, *T. palmatus* 26.0 mm, and for *T. alpestris* 37.2 mm. Hybrids produced by *T. palmatus* mothers have a body length of 25.3 ± 0.4 mm, whereas those produced by *T. alpestris* mothers average 29.1 ± 0.3 mm. The difference between these means, 3.8 ± 0.5 mm, is nearly 8 times its probable error, and so, highly significant. It follows that the cytoplasm of the *alpestris* egg at the time of fertilization must contain sources of growth energy much superior to those found in the cytoplasm of the *palmatus* egg. Whether it is legitimate to explain their presence there as a result of previous activity of maternal nuclear material remains to be demonstrated, if indeed this further question is capable of experimental solution. But at any rate an immediate effect of the maternal cytoplasm is clearly shown.

W. E. CASTLE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A LOW COST ELECTROCARDIOPHONE FOR TEACHING PURPOSES

MANY teachers, particularly those teaching physiology and physical diagnosis, recognize the electrocardiophone as an extremely valuable instrument with which to demonstrate heart and respiratory sounds to a large group of students. Until just recently, however, such equipment has been both complicated and costly, keeping many from enjoying its advantages. Recently a new type of microphone has appeared on the market which has opened the field for a simple and inexpensive electrocardiophone. The cost should not run over fifty dollars for the entire instrument.

It is the purpose of this article to describe such a unit, the outstanding features of which are simplicity, compactness and low cost, and which will do almost anything which the more complicated instruments will do.

The basis of this electrocardiophone is the crystal

type microphone as sold under the Brush patents. This microphone operates on the piezo-electric principles as defined by Curie in 1880. Thus, if crystals which exhibit pyro-electric properties are subjected to compression or tension, opposite charges of electricity appear at the ends of the crystal; thus a small alternating voltage is generated between two metal plates glued at opposite ends of the crystal. The material used for these crystals is Rochelle salts. When a sound is impressed on the crystal the bending strain will set up a voltage between the ends. This voltage is then applied to the grid of a pre-amplifier tube. No polarizing voltage or magnetic field is needed and no input transformer is used. The audio output is almost as large as that obtained from a highly damped carbon microphone. There is no background noise, and the frequency response is good enough. Several carbon microphones were tried and found to be less satisfactory, since the vibrations caused by body movements produced a good deal of rattle and

¹ *Proc. Nat. Acad. Sci.*, 20: 621-625, December, 1934; *Genetics*, July, 1936 (in press).

² *Rev. Español de Biol.*, 5: 11-93, 1936.

noise. There are several companies who sell the crystal microphone with a bell type of stethoscope on the front. A button conveniently located on the side is used to turn the instrument on and off after it has been placed in the proper position, thus eliminating much of the problem of feed-back.

As to the amplifiers, since the microphone audio level is down 60 Db. a pre-amplifier must be used ahead of the straight audio amplifier. Of course the size of the room and the intensity of the sound desired has much to do with the type of amplifier used. The amplifier to be described is sufficient for use in a lecture hall about thirty by forty-five feet and seating about one hundred and twenty students. A variety of tube combinations are available, all of which give about the same results if properly used. It is important that the microphone cable should be shielded and the shield connected to ground. The high-gain input circuit should be shielded and kept away from the high-level audio section. A.C. filament and high voltage supplies may be used for all stages of the amplifier, but excellent filtering is required for the high-gain amplifier in order to eliminate all hum. The amplifier is mounted on one metal chassis, the power supply on a second metal chassis, each one being two by eight by seventeen inches. The first stage consists in a type 6C6 tube using pentode connections and giving a voltage gain of ninety. This is resistance-capacity coupled to a second type 6C6 tube triode connected, and giving a gain of twenty-two and a half. This is in turn transformer coupled to the driver stage consisting of a pair of type 76 tubes in push-pull. The final stage is transformer coupled to this and consists in a pair of type '42 tubes in push-pull. A universal output transformer is used. The volume control is placed in the grid circuit of the second tube. A tone control for cutting off the high frequencies is placed across the output of the second tube. A type '80 tube is used in the rectifier for all stages. As to the speaker, any good small dynamic speaker is satisfactory, the field supply may be obtained from the power supply used for the final amplifier. The speaker is connected to the final amplifier through a fifty-foot five-wire cable. The speaker should be mounted in the center of a baffle not smaller than three by four feet; if the baffle is smaller, the sounds are very much distorted. Several types of magnetic speakers were tried and found to be very unsatisfactory. The speaker is placed at the back of the lecture hall, the amplifiers and microphone in the front of the room with the patient. This arrangement helps to reduce the feed-back and places the patient in full view of the class. When the lecture hall is empty the feed-back is very annoying, but when it is filled with students, as during a lecture, there is no trouble even with the gain up all

the way. The volume is more than necessary to be plainly heard from any part of the lecture hall described above.

The sounds are very realistic and there are no extraneous sounds to confuse the listener. Murmurs and irregularities in both intensity and rate of the heart are easily demonstrated, as are many of the respiratory sounds. A certain amount of common sense must be used in handling this instrument; thus a heart sound which is so faint that it is heard with difficulty with an ordinary bell type stethoscope will not be heard at all on the electrocardiophone. In general, it is best to choose a person having a fairly thin chest wall as the subject, and again it is best to have the subject either sit or stand or lie on his left side rather than to pick up the heart sounds with the patient lying on his back.

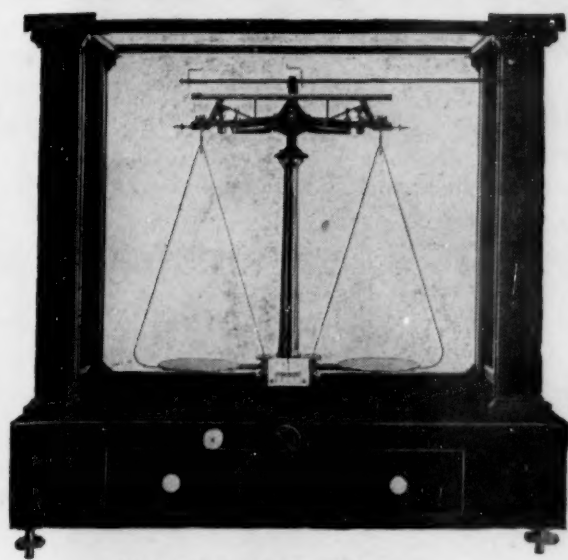
At the Temple University School of Medicine in Philadelphia such an instrument has been built by the department of physiology and it appears to be quite satisfactory for teaching. When the heart sounds are first studied, the normal sounds are demonstrated and discussed. The entire class hears the sounds in exactly the same quality and intensity and the lecturer can properly interpret what is being heard. In the same way, in the lectures in physical diagnosis it should be possible to demonstrate many of the pathological as well as the normal sounds found in the heart and lungs. In the large clinics where a patient is presented to the whole class, individual study of the patient is impossible, but with this instrument the important conditions could be demonstrated. In this way the patient is subjected to the least discomfort and the students receive the benefit of studying the patient. Since all the students hear exactly the same sounds, the pathology can not be confused with other conditions and even missed entirely, as is so often the case when a large number of persons hurriedly examine the same patient.

LAURENCE B. RENTSCHLER

TEMPLE UNIVERSITY SCHOOL
OF MEDICINE

BOOKS RECEIVED

- GRAUBARD, MARK. *Biology and Human Behavior*. Pp. 406. Illustrated. Tomorrow Publishers. \$2.50.
- PETERSEN, WILLIAM F. *The Patient and the Weather*. Vol. I, Part 1, *The Footprint of Asclepius*. Pp. xx + 127. 94 figures. \$3.75. Vol. I, Part 2, *Autonomic Integration*. Pp. xxx + 781. 366 figures. \$9.00. Vol. II, *Autonomic Dysintegration*. Pp. xx + 530. 249 figures. \$6.50. Vol. III, *Mental and Nervous Diseases*. Pp. xvi + 375. 192 figures. \$5.00. Edwards Brothers.
- REH, FRANK. *Astronomy for the Layman*. Pp. xvii + 308. 20 plates. Drawings by the author. Appleton-Century. \$3.00.
- VAN LEEUWEN, W. M. DOCTERS. *Krakatau, 1883-1933; A. Botany*. Pp. xii + 506. 61 plates. 10 figures. E. J. Brill, Leiden, Holland.



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LANCASTER, PENNSYLVANIA

SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE REVIEW OF THE YEAR

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Biology

ANIMAL growth without either paternal or maternal nuclei was demonstrated by centrifuging sea-urchin eggs and then treating them with concentrated sea-water, by Dr. Ethel Browne Harvey working at the Marine Biological Laboratory at Woods Hole, Mass.

Units of cellulose, held together in a pectin matrix, were isolated and seen for the first time by Mrs. Wanda K. Farr, U. S. Department of Agriculture, and Dr. Sophia H. Eckerson, Boyce Thompson Institute for Plant Research.

Maturing fruits and vegetables produce ethylene gas in their own tissues, it was shown by researches at three laboratories: the Minnesota Agricultural Experiment Station, the Low Temperature Research Station at Cambridge University, England, and the Boyce Thompson Institute for Plant Research, Yonkers, N. Y.

Eyes of the larva of the fruit-fly, or *Drosophila*, were successfully transplanted to the abdomens of other individuals, by Boris Ephrussi and G. W. Beadle, in Paris.

A monkey embryo in the blastocyst stage was found by Dr. George L. Streeter, director of the department of embryology, Carnegie Institution of Washington, in Baltimore.

An ornithological expedition made permanent records of the songs of rare birds in the South, working under the auspices of Cornell University and the Carnegie Institution of Washington.

Dyes of certain types render living cells more sensitive to the lethal effects of light, was discovered by Professor D. H. Tennent, of Bryn Mawr College.

The air at 20,000 feet and over was found to be germ-free by Dr. George Walker, of Baltimore.

Spores of fungi taken nearly 14 miles into the stratosphere on the flight of the National Geographic Society-Army Air Corps balloon *Explorer II* survived the cold, solar radiation and other extreme conditions of the journey.

A lily that never sheds its pollen was produced by D. N. Moore in the laboratories of the General Electric Company, by x-raying bulbs for several successive generations.

The plant hormone auxin, chemical substance stimulating growth was produced synthetically by Drs. K. V. Thimann and J. B. Koepfli, California Institute of Technology.

Irritability in protoplasm was traced to a substance of unknown composition, called "R," by Drs. W. J. V. Osterhout and S. E. Hill, Rockefeller Institute for Medical Research.

Pantothenic acid, believed to be a universal essential in growth and respiration of cells of living bodies, was isolated by Professor Roger J. Williams, Oregon State College.

Southern pine forests produced an exceptionally large seed crop.

Properly controlled fires are beneficial to growing pine woods in the South, according to evidence produced before the annual meeting of the Society of American Foresters.

Forest fires increased in number but decreased in total area burned over.

A program of basic research in biology was planned by the Department of Agriculture.

Establishment of "wilderness areas" in all countries of the Americas was advocated by Dr. John C. Merriam, president of the Carnegie Institution of Washington, in an address before the Pan American Institute of Geography.

Neon lamps were used instead of the conventional incandescents, in forcing plants and flowers in the greenhouses of the Agricultural College of Wageningen, the Netherlands.

A College of Agriculture was organized at Hebrew University in Jerusalem.

More than 3,300 ants, each part male, part female, were found in one colony in Trinidad, by Dr. N. A. Weber, Harvard University.

The Sixth International Botanical Congress was held at Amsterdam, during the first week in September.

Trees afflicted with Dutch elm disease were found in Virginia and Indiana.

A new food factor necessary for the growth of chickens was discovered by Dr. H. Dam, of Copenhagen, and named vitamin K.

Plantings were begun in the great Western Shelterbelt project, largely utilizing species native to the region planted.

Insect heads were successfully transplanted to bodies of other insects of the same species, by Dr. Atma Malabotti, Vienna Academy of Sciences.

A band of rays in the almost invisible red has a powerful retarding effect on plant growth, it was discovered by Dr. L. H. Flint, U. S. Department of Agriculture, and Dr. E. D. McAlister, Smithsonian Institution.

Methods were developed by the U. S. Public Health Service investigators to show graphically the bactericidal effect of the beta rays as compared with the non-bactericidal gamma rays of radium; and the irradiation of bacteria by radium emanations was found to produce profound cultural and morphological changes.

Air-conditioning methods were applied in the transportation of parasitic wasps used in combating insect pests.

A world-wide survey of breeding stocks of domestic plants and animals was inaugurated by the U. S. Department of Agriculture.

A "Farm Chemurgic Council," to promote the use of agricultural products in industry, was formed, with Francis P. Garvan as its first president.

Chinch bugs, much feared at the beginning of the growing season, did little damage in the Grain Belt.

On the occasion of the fifth anniversary of the plant patent law, a check-up disclosed that only 124 plants had been patented.

A comprehensive survey of the enemies of oysters was begun by the Bureau of Fisheries.

Several large wilderness areas, comprising a total of nearly 8,000,000 acres, were set aside as game preserves by the Soviet Government.

Pennsylvania's last scrap of virgin timber, 4,000 acres in extent, was acquired by the U. S. Forest Service, to be kept as a wilderness area.

Medical Sciences

The virus that causes the plant disease, tobacco mosaic, was isolated by Dr. W. M. Stanley, Rockefeller Institute, Princeton, N. J., as a crystalline protein, thus, according to Dr. Stanley, characterizing a new class of disease-producers and indicating that viruses may not be living substances in the sense that bacteria, plants and animals are.

Identification of the virus of human influenza and its cultivation outside the body were reported by Drs. Thomas Francis, Jr., and T. P. Magill, of the Rockefeller Institute.

First definite evidence of a vitamin participating directly in a physiological process was found by Dr. George Wald, Harvard University, who found vitamin A in the eye's retina and active in vision.

Relief and apparent cure of a fatal type of high blood pressure by surgical operation was reported by a number of surgeons, working independently and using different surgical techniques, among them Dr. Alfred W. Adson, Mayo Clinic; Dr. Max M. Peet, University of Michigan Medical School; Dr. Irvine H. Page, Hospital of Rockefeller Institute for Medical Research, and Dr. George J. Heuer, New York Hospital.

Study, at many research centers, of electrical impulses generated by brain activity and known popularly as "brain-waves" shows that brain activity, like heart activity, is constant but unlike heart activity, proceeds at different rates during sleeping, waking, and mental processes; that epilepsy is a sort of neurological storm set off by stimulation of a convulsion-causing brain center; that different kinds of brain activity occur under different anesthetic agents; and promises much future information about mental processes in health and disease. Scientists engaged in this research were: Drs. F. A. Gibbs, E. L. Gibbs, H. Davis, E. L. Garceau, A. Forbes, A. J. Derbyshire, B. Rempel, E. Lambert, Harvard University; Drs. H. H. Jasper and L. Carmichael, Brown University; Dr. A. L. Loomis and Garret Hobart, Loomis Laboratories, Tuxedo Park, N. Y., and Professor E. Newton Harvey, Princeton University.

Electrical impulses generated in the brain during sleep and dreams are paralleled in the case of deaf-mutes by similar impulses in the hands and arms, which they use in speech, experiments by Dr. Louis W. Max, New York University, disclosed.

A substance that can be applied to the outside of teeth to relieve pain during drilling and other dental procedures was announced by Dr. L. L. Hartman, Columbia University.

Dr. William H. Howell, emeritus professor of physi-

ology, the Johns Hopkins University, discovered that the blood platelets are formed in the lungs by giant cells called megacaryocytes.

Heart muscle tone is the chief factor influencing the blood flow through the heart's arteries and should be considered in prescribing drugs for heart disease due to occlusion of these arteries, Dr. William B. Kountz, Washington University School of Medicine, reported.

Choline, produced by the pancreas, is a vitamin essential for liver function and probably an important factor in control of diabetes, Dr. C. H. Best, co-discoverer of insulin, and Dr. M. Hershey and Miss M. E. Huntsman, all of the University of Toronto, found.

Relief of several cases of hitherto hopeless Pick's disease by surgical removal of part of the pericardium was reported by Drs. Paul D. White and E. D. Churchill, Massachusetts General Hospital, Boston.

A new hormone, enterogastrone, produced by the upper intestinal walls, which may aid treatment of stomach ulcer because it inhibits stomach activity, was announced by Professor A. C. Ivy, Northwestern University Medical School.

Synthetic production of male sex hormones was reported by Dr. L. Ruzicka, Zurich, Switzerland.

Evidence presented by Dr. L. G. Rowntree and colleagues indicates that extract of pineal gland causes precocity of sexual development and premature cessation of body growth.

First scientifically controlled test of the Park-Brodie infantile paralysis vaccine was made by U. S. Public Health Service on over 1,000 children during the North Carolina epidemic, but was inconclusive as no cases developed in either control or vaccinated groups.

A slight drop in the cancer death rate appeared in life insurance statistics for the first nine months of 1935.

Length of life can be predicted by measuring change of the eye lens' power of accommodation, early presbyopia indicating probability of a shorter than average life, Dr. Felix Bernstein, Columbia University, found from research on thousands of individuals in Germany.

Progress in cancer research was marked by chemical studies of cancer-producing substances; one of these, methylchloranthrene, was made synthetically by Professor Louis F. Fieser and M. Fieser, E. B. Hershburg, M. Newman and A. M. Seligman, Harvard University; discovery of two new cancer-producing chemicals, tetraphenylmethane and triphenylbenzene, by Professor Avery A. Morton and Dr. Donald B. Clapp, Massachusetts Institute of Technology, and Dr. Charles F. Branch, Evans Memorial Hospital, Boston, show that the production of cancer by pure hydrocarbons is much more general than supposed.

Discovery that the female sex hormone produces tissue changes similar to beginning stages of cancer furnished evidence of a long-suspected but unproved relation between sex and cancer to Professor J. B. Collip and Drs. H. Selye and D. L. Thomson, of McGill University.

Inoculating cancer cells into the skin instead of under it made mice immune to cancer, is reported by Professor

Alexandre Besredka and Dr. Ludwik Gross, of the Pasteur Institute, Paris.

Discovery, in connective tissue tumors, of sex hormones which definitely influenced growth of the tumor indicated to Dr. Charles F. Geschickter and Dean Lewis, the Johns Hopkins Hospital and University, that a connection may exist between sex and cancer.

Further support of the idea that heredity plays a part in cancer was seen by Dr. Raymond E. Miltzer, Pondville Hospital, Massachusetts Department of Public Health, in the first known cases of simultaneous occurrence of stomach cancer in identical twins.

Isolation of the active principle of ergot, drug used in childbirth, was announced by several investigators, working independently.

A new amino acid, alpha-amino-beta-hydroxybutyric, essential for growth and life, was discovered, identified and prepared synthetically by Dr. William C. Rose and associates, Dr. H. E. Carter, Richard H. McCoy and Madelyn Womack, University of Illinois.

A substance which checks the action of the important digestive enzyme, trypsin, was discovered, isolated and prepared in pure crystal form by Drs. John H. Northrop and M. Kunitz, Rockefeller Institute for Medical Research, Princeton, N. J.

Ventricular fibrillation, fatal heart condition and auricular fibrillation, another grave heart disorder, may be caused by the external nerves of the heart, researches by Drs. Louis H. Nahum and H. E. Hoff, Yale School of Medicine, revealed.

Ultra-violet rays, heat and calcium salts are three inter-related factors in the production of cataract, Dr. Janet Howell Clark, the Johns Hopkins School of Hygiene and Public Health, found.

Maternal instinct in young rats is due to the influence of prolactin, pituitary gland hormone, and can be aroused in young virgin rats by injections of this hormone, was found by Drs. Oscar Riddle, Ernest L. Lahr and Robert W. Bates, Carnegie Institution of Washington.

Effect on the body of thyroid gland hormone and thyroid stimulating hormone of the pituitary gland is greatly influenced by temperature, lowered metabolic rate being produced by either of these hormones when given at 59 degrees Fahrenheit, Drs. Oscar Riddle, Ernest L. Lahr and Robert W. Bates, Carnegie Institution of Washington, found.

Important aid for the treatment of liver disease and for preparing patients suffering from fatty livers for operation was the discovery by Drs. J. L. Bollman and F. C. Mann, Mayo Clinic, that the composition of the liver can be varied within wide limits by diet.

Breeding experiments with mice, reported by Dr. E. C. MacDowell, Carnegie Institution of Washington, indicate that occurrence of leukemia, cancer-like condition of white blood cells, is increased through inheritance on the maternal side.

A method for keeping glands and possibly other organs alive outside the body by feeding a blood substitute by a mechanical "heart" was reported by Dr. Alexis Carrel, Rockefeller Institute, and Colonel Charles A. Lindbergh.

Cause of the paralytic disease, multiple sclerosis, may

be clotting of blood in the small veins of the brain, possibly as a result of infection, researches by Drs. Philip Solomon, Mary E. Dailey and Tracy J. Putnam, Harvard Medical School, indicated.

The world's record smallest viable baby, weighing one pound at birth, was born in El Paso, Texas.

Putting a specially prepared fat or olive oil mixture into the veins is a new method developed by Drs. L. Emmett Holt, Jr., Herbert C. Tidwell and T. F. McNair Scott, the Johns Hopkins Hospital, for treating babies suffering from severe nutritional disorders.

A new function of the pituitary gland, control of the reticulo-endothelial system, which is concerned with production of new blood cells and destruction of old ones, was indicated in experiments of Professor E. C. Dodds, Courtauld Institute of Biochemistry, and Dr. R. L. Noble, London.

First part of the human brain to develop is the area controlling what is called the body sense, Dr. Frederick Tilney and associates at the Neurological Institute, New York City, found in a study of the correlation between brain development and human behavior.

New evidence for the resonance theory of hearing was found by Dr. Elmer Culler, University of Illinois, and Dr. S. S. Stevens, Harvard, who, working independently, mapped the basilar membrane, locating experimentally the areas where each frequency range is picked up.

Very intense noise causes deafness for pitches other than that of the stimulus and injury in the ear's organ of Corti at points not involved in picking up moderate tones of similar pitch, researches at Harvard, Clark and Princeton Universities indicated, providing evidence that the resonance theory of hearing may need modification.

Evidence that the stimulus to the nerve of hearing is chemical and not electrical was obtained in researches by Drs. A. J. Derbyshire and H. Davis, Harvard Medical School.

A loud high-pitched sound produces more ear strain and greater loss of hearing if it is interrupted every second instead of being continuous, Dr. Elmer Culler and Glen Finch, University of Illinois, reported.

Chemical analysis of crystals of the fertility vitamin, E, show it to be a quite complex higher alcohol, Drs. H. M. Evans, O. H. Emerson and G. A. Emerson, University of California, reported.

An international clearing-house for serums used in treating, diagnosing or preventing disease was established at the Royal Danish Serum Institute, Copenhagen, by action of the Congress of Biological Standardization in connection with the League of Nations Hygienic Congress.

First step toward a simpler, cheaper and safer method of making Rocky Mountain spotted fever vaccine was apparently taken by Dr. R. E. Dyer and Ida A. Bengtson, U. S. National Institute of Health, when they succeeded in growing the virus of this fatal disease on chick embryos.

A physiological approach to methods for correction of stuttering was suggested by the finding of Hazle Geniesse, University of Michigan, that walking on all fours enabled stutterers to speak normally.

Four Important New Books

Hund—Phenomena in High-frequency Systems

By AUGUST HUND, Consulting Engineer. *International Series in Physics*. 605 pages, \$6.00

This new book deals not only with high-frequency phenomena, but also discusses phenomena within parts of apparatus and systems which are used in the radio-frequency as well as in the communication field. The fundamental principles and laws applying to high-frequency apparatus and systems are presented together with a thorough treatment based on experimental evidence and theoretical significance. A brief review of classical experience and theory precedes many of the discussions.

Seifriz—Protoplasm

By WILLIAM SEIFRIZ, Professor of Botany, University of Pennsylvania. *McGraw-Hill Publications in the Agricultural and Botanical Sciences*. 571 pages, \$6.00

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOLAR ECLIPSE OF JUNE 19

AN expedition to Soviet Russia to observe the total eclipse of the sun on June 19, 1936, will be sponsored by the Harvard College Observatory in collaboration with the Massachusetts Institute of Technology. In charge of the expedition will be Dr. Donald H. Menzel, of Harvard, assisted by Dr. Joseph C. Boyce, of the Massachusetts Institute. Other members of the party have not yet been announced.

The totality belt, about 75 miles wide, starts in the Mediterranean and then swings northeastward across Greece, the Black Sea, Manchuria and northern Japan, ending at some point well out in the Pacific Ocean. The eclipse will not be visible in the western hemisphere.

According to Dr. Menzel, the party's program will be chiefly spectrographic, with particular effort to be directed to obtaining spectrograms of the chromosphere and the corona over a wide range of wave-lengths. Special emphasis will be placed on the infra-red region of the spectrum, where present knowledge is only fragmentary.

The chromosphere, technically the outer layers of the sun, is a rarefied atmosphere enveloping the shining surface. Due to the brilliance of the sun, observations of the chromosphere are best obtained during an eclipse when the sun is hidden and only the rarefied atmosphere protrudes from behind the moon. From the observations to be taken, it is hoped that its chemical composition, the source of its excitation, the nature of its structure and many other problems in connection with the chromosphere may be cleared up.

The solar corona which lies above the chromosphere presents additional mysteries. Although the chromosphere has been spectrographically found to consist of helium, hydrogen, calcium, iron and other elements in their gaseous form, not a single one of the many known coronal lines has been positively identified.

Some believe that the predominant element is a well-known substance, hidden by peculiar conditions existing in the corona. Dr. Menzel and Dr. Boyce have provisionally suggested that oxygen might be responsible, but additional data which may be obtained from the contemplated study of the infra-red coronal spectra are required to settle the question.

The Harvard-Technology expedition will be the guests of Dr. Boris P. Gerasimovic, formerly associated with the Harvard Observatory and now director of Pulkova Observatory at Leningrad. Observations will be made from a point near the town of Ak-Bulak in the southern Ural Mountains. Although Tomsk is a more favorable location, since it lies close to the central totality line and since the sun will be higher in the sky there, collected weather reports indicate that the chances for clear weather are appreciably greater at Ak-Bulak. Totality here will occur at 8 A. M., local time, when the sun is 36 degrees above the horizon.

Dr. Boyce will sail early in February and will spend

two months at the Solar Physics Observatory, at Cambridge, England, before proceeding to Russia. The rest of the party will sail some time in April.

THE HYDROGEN OUTBURST ON THE SUN AND RADIO FADING

A SUDDEN outburst of hydrogen from the sun preceded the diminution in radio intensity on the earth observed on October 24, according to R. S. Richardson, of the Carnegie Institution's Mount Wilson Observatory, who spoke before the American Astronomical Society meeting at Princeton University.

Mr. Richardson's work followed announcement of such fadeouts by Dr. J. H. Dellinger, chief of the radio section of the National Bureau of Standards. Another such eruption of hydrogen occurred on August 30 when a sudden and mysterious fading of short-wave radio transmission was noticed for about fifteen minutes at the National Bureau of Standards. Fadeouts also occurred on March 20, May 12 and July 6, the interval between them being just about twice the period that the sun takes to rotate.

Dr. Dellinger suggested that they might be associated with some sort of solar eruption, and the October 24 photographs were taken as a result of his request that careful observations be made of the sun at the time of the next expected occurrence. Earlier observations were studied as well.

It was found that an eruption, probably rather small, was recorded in July, but no unusual activity was noticed at the time of the first two dates. However, no observations had been made at the exact time of the fading. Such a hydrogen eruption is called a flocculus, and Mr. Richardson reported that "when the sun is observed for half an hour each day at this phase of the solar cycle we may expect to photograph about ten such flocculi in one year."

Beginning on October 21, photographs of the sun were made by the spectroheliograph, which records the light from a single element, hydrogen in this case, at intervals not greater than ten minutes wherever possible. Between that date and October 25 a total number of 323 exposures were made, an average of one every eight minutes during observing hours. A small flocculus was photographed on the first two days without any sign of great activity, until the time of one exposure made on October 24.

"On the next image, taken twenty-one minutes later," said Mr. Richardson, "the flocculus had increased in intensity until it was the most conspicuous object on the disk seen in a hydrogen spectroheliogram. It was stronger than the one photographed on July 6, but never reached the intensity of the one on August 30."

Until this date there had been a general improvement in radio transmission in the short-wave bands and it had reached the highest value ever recorded at the Bureau of Standards on October 24. There was no sudden fadeout such as those noticed before, but the upper limit of

frequency dropped to half of the value on the preceding day, and on the following days returned to the previous high value.

Earlier observations were examined, as well as records of magnetic storms. One very brilliant cloud of hydrogen appeared on June 5, 1925, while the number of sunspots was low, and a magnetic storm followed four days later. An equally brilliant eruption appeared on December 28 and 29, 1928, when the spots were numerous.

"The magnetic character of the day was calm during the eruption and was very calm and at most only slightly disturbed for a week afterwards," it was stated. "Other examples like these might be cited to show the difficulties encountered in attempting to correlate solar and terrestrial phenomena."

THE ENERGY LINKING ATOMS IN MOLECULE

A NEW experimental step which should aid the development of a better theory of how the atoms in a molecule are linked together was described recently by President James Bryant Conant, of Harvard University, before the Sixth National Organic Symposium of the American Chemical Society.

In previous research, Dr. Conant explained, the energy changes involved in the linkages of the atoms in molecules of organic compounds has been found by burning the compounds and measuring the heat given out. The new Harvard experiments, conducted by Professor G. B. Kistiakowsky with Dr. J. R. Ruhoff, W. E. Vaughan, H. A. Smith and H. Romeyn, obtain the amount of heat liberated directly, said President Conant.

"The first example chosen for study was the reaction of a molecule of hydrogen with a hydrocarbon which is deficient in hydrogen; that is, an unsaturated compound," said Dr. Conant. "When the two molecules come together in the presence of a catalyst they combine and heat is evolved; this heat, which is a measure of the affinity of the carbon compound for the extra hydrogen, is measured directly in the new procedure."

"The values thus obtained are much more reliable than those previously available calculated from the heats of combustion. Because of the increased accuracy, slight differences in the affinity of different compounds for hydrogen were revealed. The explanation of such variations in affinity which occur with changes in the mode of linkage of the atoms in a molecule is a theoretical problem of much importance. When more accurate data are available from the studies in progress, it should be possible to develop to a better stage the fundamental theory of the linkage of atoms in molecules."

Dr. Conant was emphatic in his statement that he himself had not carried out the research program, explaining that the press of administrative duties prevented his active participation. His contribution, he pointed out, was made three years ago when he and Professor Kistiakowsky planned the five-year program financed by the Rockefeller Foundation.

SYNTHETIC PRODUCTION OF MUSK AND CIVET FOR PERFUMES

PRACTICAL synthesis of the organic chemical compounds in musk and civet that give choice perfumes their odor

was reported by Dr. Wallace H. Carothers, du Pont chemist, speaking before the recent National Symposium of Organic Chemistry at Rochester, N. Y. Chemists are about to manufacture in the laboratory pure essences such as that of "muscone," which if made from the rare musk animal would cost \$40,000 a pound.

A new field of chemistry is opened by the researches of Dr. Carothers and his collaborators, Julian W. Hill and E. W. Spanagel, who have developed theory and method of control of synthesis of what chemists call "large ring" compounds of high molecular weight. These large rings of chemical molecules may also prove of use in medicine, as the Chinese use musk in medicine and investigations may demonstrate scientific medical uses.

Based upon the 1926 discovery of the Swiss chemist, Ruzicka, that the essential principles of musk and civet are chemicals of large-ring type, the du Pont research has aimed to make this discovery practically available. "Muscone" and "civetone" are the only known examples of such chemicals found in the animal world.

Lower grade perfumes have long been made synthetically and there are also synthetic imitations of musk. In fine perfumes the function of musk, although unpleasant in large quantities, is to blend the various odors into a single fragrance as well as to confer permanence on odors that otherwise would be fugitive. The new chemical research has the possibility of bringing to the boudoir new synthetic odors that nature has not imagined.

SCIENCE REVIEW OF THE YEAR

(Copyright, 1935, by Science Service)
Engineering

A NEW system of ultra-short wave radio transmission, which is less subject to static, was developed by Major Edwin H. Armstrong, professor of electrical engineering, Columbia University.

A commercially practical method of applying non-corrosive coating of aluminum on iron and steel was patented by Professor Colin G. Fink, Columbia University.

"Coaxial" cable, which will carry 240 telephone talks or a high-grade television circuit, was announced by the Bell System.

Electric power transmission by direct current, employing vacuum tubes, was announced by General Electric laboratories.

Maine's Passamaquoddy Bay tide power project was begun.

A new type of color film for 16 mm. home movies, which does not require a special filter and consists of five layers sensitive to red, green and blue-violet light, was introduced by the Eastman Kodak Company.

The liner *Normandie* established new records for crossing the Atlantic, westward on June maiden voyage in 4 days, 11 hours, and 42 minutes, eastward in 4 days and one hour.

The highway bridge at Grand Coulee Dam was the first structure completed on the Columbia River project.

First traffic was begun over the Zambesi River railroad

bridge in Africa which has a length of 12,064 feet, said to be the longest in the world.

The new automobile traffic tunnel beneath the Hudson River at West 39th Street, New York City, was "holed through."

The "voice mirror," which records speech on a magnetic tape and immediately plays it back to the speaker, was demonstrated by Bell Telephone Laboratories.

Talking around the world was at last accomplished when speakers in adjoining rooms in New York conversed over a wire and radio circuit.

A new alloy of iron, aluminum, nickel and cobalt, and named Alnico, was announced by General Electric as a powerful permanent magnetic material.

Electrification of the Pennsylvania Railroad from New York to Washington was completed.

A new type of heavy tungsten alloy was developed in England for making more compact "bomb" shields for radium in place of the lead shields now used.

New sound detectors invented for the U. S. Army were claimed to detect an airplane 12 miles away.

Construction was under way in Great Britain on a new non-magnetic ship to replace the lost *Carnegie* of the Carnegie Institution of Washington in the field of world-wide marine magnetic surveys.

A new type of telephone transmitter with low noise level and freedom from line noises was developed by the Bell Telephone.

A machine with a "memory," which makes complete records of such quick happenings as lightning strokes before, during and after they occur, was developed at the General Electric Research Laboratory.

A system of high detail television was begun experimentally by the Radio Corporation of America.

A new high temperature for commercial electric furnaces, 3,000 degrees Centigrade, was obtained in the new rotating type developed by M. Henri George, Electrothermal Laboratory, Paris.

A process of printing from rubber plates was developed by the B. F. Goodrich Rubber Company.

New developments in the construction of secondary highways for light traffic included the use of salt as a binder and of cotton webbing to prevent wrinkling of the surface.

A garbage grinding device which aids disposal of kitchen waste down the sewer drain was introduced by the General Electric Company.

Waterproof wood, embalmed clear to its center with wax, was developed at the U. S. Forest Products Laboratory.

Patent No. 2,000,000, which is for the construction of rubber tires for railroad trains, was awarded by the U. S. Patent Office.

ITEMS

A JOINT expedition to observe the next total eclipse of the sun—scheduled to sweep across Asia on June 19—will be sent to Soviet Russia by Georgetown University and the National Geographic Society, it is announced by the two sponsoring organizations. Dr. Paul A. McNally, S.J., director of the Georgetown College Observatory, will be leader of the expedition, accompanied by

five others to be chosen from the staffs of the university and the society. They will leave sometime in April and return in July. Observations will be made from a point near Orenburg, Soviet Russia, because past weather records show that this region offers one of the best promises of clear weather along the path of the eclipse.

PHOTOGRAPHIC films and plates have been much improved, in German manufacturing establishments, through the use of "supersonic" waves—sound waves vibrating so rapidly that they are inaudible to human ears. It has been found that the minute particles of silver bromide, which form the light-sensitive part of the photographic emulsion, are distributed more evenly over the surface, and do not tend to clump together, when the emulsion is treated with these extremely rapid vibrations. Effects of supersonic waves on emulsions were first studied in the United States some years ago by Professor R. W. Wood, of the Johns Hopkins University, and A. L. Loomis, working in the latter's private laboratory at Tuxedo Park, N. Y.

DR. FREDERIC E. CLEMENTS, botanical ecologist on the staff of the Carnegie Institution of Washington, told Science Service last spring that a study of weather cycles indicated that the great drought might be expected to break during the present year. This was after the early months of 1935 had brought a recurrence of the terror-inspiring dust storms of 1934. Now, at the end of the year, Dr. Clements can look back and see a record of heavier-than-ordinary rains. There is still a drought area, but it has dwindled to a mere patch of the Great American Desert of the several preceding years.

A CONNECTION between cancer and sex hormones appears in researches by Drs. Charles F. Geschickter and Dean Lewis, of the Johns Hopkins Hospital and University, as reported in the *American Journal of Cancer*. Hormones from both male and female sex glands and the sex hormone of the pituitary gland were found in one type of cancer known medically as tumors of connective tissue. No conclusions can be drawn from these findings, the investigators state, except that the sex hormones probably are "concerned in the physiology of the tumor." Tumors of connective tissue seem to have the power to concentrate or hold both the gonadotropic substance of the anterior pituitary gland and oestrogenic substance which is secreted by both ovary and testicular tissue. These hormones are not merely stored in the tissue but have a definite influence on its growth, experiments showed.

THE reason for black boiled potatoes has been determined by Professor W. E. Tottingham, of the College of Agriculture of the University of Wisconsin. Through his experiments he has proved that this discoloration is the result of the formation of pigment products which appear when the potatoes are grown in soil having a lack of potash fertilizer. The lack of potash in the soil causes the formation of certain organic compounds known as amino acids. These compounds oxidize to form the color pigments that discolor the potato.

SCIENCE NEWS

Science Service, Washington, D. C.

THE LIGHTEST SOLID

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THE lightest solid material ever made by man or found on earth has been produced at the Franklin Institute's Bartol Research Foundation laboratories at Swarthmore, Pa. It is a variety of lithium, lightest metal. It is lithium of atomic weight 6, the lightest of the two kinds or isotopes of this element. By comparison iron of atomic weight of over 55 is extremely heavy. This lightest solid is less than twice as heavy—atom for atom—as the gas helium used by the U. S. Government to inflate its airships.

The production of the world's lightest solid was achieved by Dr. L. H. Rumbaugh, who used electromagnetic means in the Swarthmore, Pa., laboratories. Dr. W. F. G. Swann, director of the laboratories, gave the first hint of the achievement in a lecture before the New York Electrical Society on January 5. Only the merest speck of material has yet been obtained, but as the result of four years of research there is hope of ultimately concentrating, in usable amounts, the rare isotopic varieties of the elements.

Heavy hydrogen, or deuterium, the heavyweight isotope of common hydrogen was the first of the chemical isotopes to be concentrated. For its identification and concentration Professor Harold C. Urey, of Columbia University, recently won the Nobel Prize in chemistry. The only other isotope ever concentrated in usable amounts is that of the gas neon, widely used in the red advertising signs, which was produced recently by Dr. Gustav Hertz in Germany. Concentration of solid isotopes is much more difficult than that of gaseous elements.

Dr. Rumbaugh's apparatus ionizes lithium so that the atoms have electrical charges upon them, and then shoots them into a magnetic field which acts as a sorter to spread different weight isotopes out onto a collecting strip. The magnetic field also acts as a lens to concentrate the ion beam into tiny deposits.

The "lightest" solid as a variety of lithium stands next to hydrogen and helium in the chemist's table of atomic weights. The relative weights of hydrogen, helium and lithium as determined by chemical tests are roughly as one is to four is to seven. Actually hydrogen's atomic weight is 1.0078 and the gas is composed of hydrogen of atomic weight 1, deuterium of mass two and a trace of hydrogen of mass three, all mixed in such proportions that the average atomic weight comes out to be 1.0078. Similarly lithium's real atomic weight is 6.940, composed of a mixture of lithium of mass six and lithium of mass seven, with the mass seven variety, of course, greatly predominating.

ELECTRON "MICROSCOPE" FOR THE STUDY OF THE ATOM

STILL another new tool by which science can study the atom and effect transmutation of the elements has been developed at the Ohio State University, according to an

announcement from the department of physics and astronomy. This is the first successful production of strong narrow beams of negatively charged hydrogen atoms which can serve as "bullets" for use in atom bombardment research. It is the work of Dr. Willard H. Bennett and Paul Darby, of the physics department.

The hydrogen atom normally consists of one positively charged nucleus called the proton, and one negatively charged electron. It is now well known that these electrons can be knocked off and beams of protons or positively charged hydrogen atoms obtained. Positive ion beams of most elements have been familiar in laboratories for thirty years or more, but never before has any one been able to attach extra electrons to atoms and make them stick in sufficient quantity to obtain beams of negatively charged ions.

Production of the negative ions in quantity is described as having far-reaching effects in research with the new million volt tube at the Ohio State by which transmutation of the elements is effected. Since investigators previously have been unable to obtain negative beams of any element, the physical properties of such ions themselves hold great interest and will be a subject for further study. They are thought to play a decisive rôle in the production of striations in glow discharge, a familiar case of which is the discharge in a neon sign. Heavy hydrogen atoms, found in heavy water, probably behave in a similar fashion, and the properties of negative heavy hydrogen-ions can be studied just as easily.

An "electron microscope" played a prominent part in the discovery of these beams. This "microscope" is a vacuum tube whose parts focus the beams of charged particles on a screen, just as the lenses in an ordinary microscope focus the beams of light on a screen. It was so used that ions of all masses and charges could be focused on one screen and then separated by a transverse magnetic field.

SAFETY AND RAILROAD LOCOMOTIVES

THE thousands of passengers who speed each month between New York and Washington at 90 miles an hour behind great electric engines rightly take their safety for granted. But the story of how railroad engineers solved the safety problem and answered the question, "How fast can a locomotive travel in safety?" has been given exclusively to Science Service by the Pennsylvania Railroad.

High speed trains tearing over an experimental stretch of artificially roughened track; recording devices at each railroad tie measuring side thrust of the wheels, and automatic apparatus in the cabs of locomotives obtaining permanent records of the sway at the wheels, in the cab and at important bearings, are only part of the picture of behind-the-scenes tests to insure safety at high speeds.

When complete electrification of the more than 200 miles of mainline track between New York and Washington was decided upon, it was seen immediately that with

the almost unlimited electric power available, nearly any speed within reason—100, 120 or 150 miles an hour—could be used. But—how much of it could be used in safety as a regular running speed?

Limiting the safe speed was the amount of side sway, or "swing," of the locomotive. But no one knew how much such sway might be or what effect different degrees of roughness in the track might have on the sway.

A special test section of track, 440 feet long, was built in the main line of the railroad near Claymont, Delaware. The track was laid on steel ties with the rails resting on rollers on top of the ties. At each end of every other tie an ingenious pressure recording instrument was placed. These instruments were very simple. They consisted merely of a hardened steel ball held against a firmly supported steel plate. When a locomotive passed over the track, and there was a side thrust, the steel ball was forced into the softer plate, and by measuring the depth of the indentation, the thrust could be measured. The plate was moved slightly forward after every test. These tests gave very accurate results, but they did not tell which wheels of the locomotive gave the thrust.

While such tests were in progress, unknown to the passengers speeding over the experimental section, the engineers of the road asked themselves, "What wheels are extending the greatest side thrust and how is the thrust distributed among the wheels?"

To answer this question, inherent in any problem of choosing the best type of electric locomotive, other equipment was needed. Therefore a device was worked out to ascertain the changes in side pressure in the hubs of each of the driving wheels and in the truck wheels. This was a device that showed a change in electric current as the pressure in the hub changed. In the engine cab was a device that caused a beam of light from a mirror to swing back and forth as the pressure changed. This beam was directed upon a photographic film which, when developed, gave a record of the changes in pressure at each swing of the locomotive.

From the results of these tests it was decided to build electric locomotives with six drivers on each side. After making corrections in the design of locomotives as the result of these tests, it was found that the side pressure on the rails was no greater at a speed of 90 miles per hour than it formerly was at 70 miles per hour.

A locomotive has been developed therefore that can pull the heaviest passenger train over existing tracks at a speed of from 90 to 100 miles per hour at absolute safety and efficiency. In this way a great railroad fixed the maximum safe speed of its passenger trains, a result arrived at through scientific investigation and a perfect balance of the new and most powerful electric passenger locomotives. The result was the development of the GG-1 type engine, which costs \$260,000 each, and develops 4,620 horsepower.

RAIN OF METEORS AS THE CAUSE OF THE CAROLINA BAYS

DR. GERALD R. MACCARTHY, associate professor of geology in the University of North Carolina, speaking

before the New York City meeting of the Geological Society of America, stated that a great rain of meteors from the sky is still the only plausible explanation of the great oval shaped depression known as the Carolina bays which dot the coastal plain of the southeastern states.

The bays were much larger than the meteors which produced them, for they were accompanied by terrific air-blasts which increased the size of the hole they made in the ground. Moreover, the air-blasts did not exert their force in the same direction as the meteors and thus the elliptical depressions that make up the bays are not necessarily parallel to the direction in which the meteors were moving when they struck the earth. This variation of the bays' axes from a constant line has been one of the major criticisms of the hypothesis that the depressions were caused by meteoric visitors to the earth.

The meteors, said Dr. MacCarthy, were probably turned almost completely from solid iron to gases because of the great heat produced at their impact with the earth. The observed magnetic attraction of the bays can be attributed to the partial condensation in the holes of iron vapor produced when the meteors crashed.

The alternative suggestion for the formation of the Carolina bays was that they started as fresh water lakes occupying depressions on a beach, said Professor Douglas Johnson, geologist, of Columbia University. The general oval shape of the bays could have been caused by the action of wind blowing on the loose sand from the southeastern direction toward the northwest. It is from the southeast that the winds of maximum velocity are known to come.

SOIL EROSION SURVEY IN SOUTHEASTERN STATES

THE relation between soil erosion and the silting of six reservoirs will be studied in a new survey in the states of Virginia, North Carolina, South Carolina and Georgia, according to an announcement made by the Soil Conservation Service of the U. S. Department of Agriculture.

H. H. Bennett, chief of the service, stated that previous surveys have already determined on the silting of the six reservoirs in question and now new studies seek to determine just how serious the soil erosion problem really is in connection with silting.

"Completion of the surveys," according to Mr. Bennett, "will give to the service authoritative information of the direct relationship of soil erosion to costly reservoir silting. It may be possible to show how the soil washed from a farm several miles from a reservoir directly contributes to the expensive sedimentation of that reservoir. Millions of dollars in investment values are lost each year because of this reservoir silting and the surveys will show the value of soil conservation and erosion control in protecting these investments."

One survey will cover the watershed area lying above the High Rock, N. C., reservoir. This is an area of approximately 4,750 square miles, including all or parts of Surry, Wilkes, Rowan, Iredell, Davidson, Davie, Forsyth, Yadkin, Stokes, Randolph, Catawba, Caldwell, Alexander, Ashe, Alleghany, Watauga, Cabarrus and Guilford counties in North Carolina, and Carroll, Patrick and Grayson

counties in Virginia. Included in this area is a watershed of four square miles lying above Lake Concord, which will be surveyed with a view to correlating the extent of soil erosion with the extent and rate of sedimentation in the lake.

Two other surveys will be started in North Carolina. One, in the watershed area lying above Lake Michie, will cover approximately 170 square miles in parts of Person, Orange and Durham counties. The other, in the watershed area lying above University Lake, will cover approximately 27 square miles in portions of Orange and Chatham counties. In South Carolina, the survey will cover approximately 89 square miles in Greenville and Spartanburg counties, in the watershed area lying above the Spartanburg Municipal Reservoir.

All or parts of 13 counties will be covered by the survey in Georgia. Approximately 1,850 square miles in the watershed area lying about the Lloyd Shoals Reservoir, including all or parts of Gwinnett, Barrow, Fulton, De Kalb, Clayton, Fayette, Henry, Spalding, Butts, Jasper, Newton, Rockdale and Walton counties will be surveyed.

Temporarily, G. A. Crabb, of the Soil Conservation Service, will be in immediate charge of the erosion surveys in the four southeastern states. Headquarters for the work in Virginia and North Carolina has been established at Winston-Salem, N. C. Headquarters for the work in South Carolina and Georgia have been established at Atlanta, Ga.

ITEMS

A CHECK in the thirty-year decrease in the birthrate of the United States and continued good health conditions in general throughout the country were reported to the Congress by Dr. Hugh S. Cumming, surgeon-general of the U. S. Public Health Service. About 94,000 more babies were born in the United States in the calendar year 1934 than in 1933. Later figures are not yet available. The report covers activities of the U. S. Public Health Service only for the past fiscal year, ending June 30, 1935. More babies were born, but there was also a slight increase in deaths of infants under one year of age per 1,000 births. The infant mortality rate for 1934 was slightly higher than for 1933, but lower than for any year earlier than 1932. The deathrate for the general population was also slightly higher in 1934 than 1933, but again was lower than any recorded rate earlier than 1932. For 1934 the deathrate was 10.9 per 1,000 population.

THE rate of flow of a glacier depends in part on the weather, according to a report of the Harvard-Dartmouth Crillon Expedition, which last summer made hourly observations on the great Crillon Glacier in Alaska, day and night for a whole week. It was found that the ice flowed nearly twice as fast in clear, warm weather as on dark, cloudy days. Sometimes the ice came almost to a full stop, while at other times it flowed at a rate of more than two feet a day. The expedition was under the leadership of Bradford Washburn.

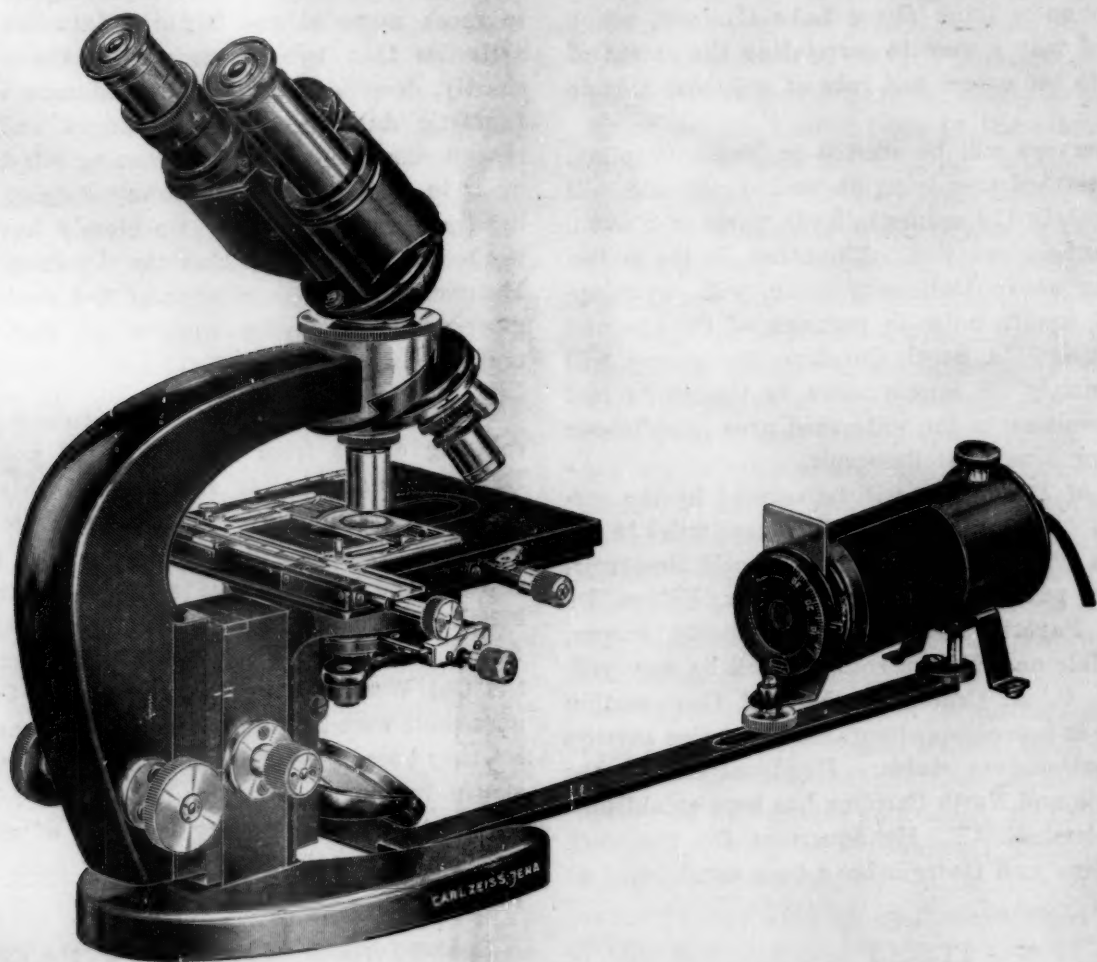
TOMBSTONES in the yard of Ivan the Terrible's bodyguards have been unearthed during construction of the

subway at Moscow. Soviet archeologists have gathered so much material and historic data from the subway activities that two volumes are announced to appear shortly, describing their finds. Moscow is noted for its fantastic dungeons, secret passages and other subterranean surprises. More archeological discoveries were made in a single year of subway digging than during a hundred years previous. So closely have archeologists worked with engineers that the Academy of History of Material Culture—in charge of the work—stationed its representatives among workers of each shaft of the underground railway.

AMERICAN barbed-wire manufacturers are said to be refusing orders from the belligerent powers in Africa. But something similar from America is at the front. Cactus is figuring in news pictures from the Ethiopian war zone. Machine-gun nests are shown flanked or half-camouflaged by huge plants of flat-jointed prickly pear bristling with spines. All true species of cactus are of American origin. The prickly plants were unknown in the Old World before the voyages of Columbus. But once cacti were introduced from Mexico and South America they became established all around the Mediterranean shores in amazingly quick time, and from there they spread throughout the dry lowlands of northeast Africa and southern Asia, until now they seem normal, native parts of the landscape.

BLAME for lack of knowledge of the extent of tropical diseases in the United States was placed squarely on the practising physicians by Colonel Chas. F. Craig, director of the department of tropical medicine of Tulane University School of Medicine, in his presidential address at the meeting, in St. Louis, of the American Academy of Tropical Medicine. Physicians not only fail to report tropical disease cases and deaths, they do not even diagnose them correctly, Colonel Craig charged. In the case of malaria, for example, many physicians still make their diagnosis from the patient's symptoms instead of examining his blood to determine the presence of the organism that causes malaria. There is no excuse for this because even if the physician is unable to make the blood examination himself, the various State Boards of Health will do it for him if he sends in a sample of the patient's blood.

SOVIET designers are strenuously working to make parachutes handier, safer and easier for transportation. An improved type of parachutes for glider pilots has been made which meets the limited space in the glider, where the bulky standard parachute can not be used. Of great interest also is a new controllable parachute. The diameter of the aperture in the center of the parachute dome has been increased to thirteen feet, and can be closed at the wish of the parachutist with special valves. When the aperture is opened, the parachutist falls at a regular speed of 25 to 30 meters a second. By partly closing the aperture with the valves, he can change the speed of his fall at his will, and by closing all valves he reduces the speed to normal, enabling him to land safely. Lighter and less strong fabric may be used in the manufacture of the new parachute, which will reduce its weight.



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SCIENCE NEWS

*Science Service, Washington, D. C.***THE NEW TELESCOPE FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY**

THE largest unit of the great 200-inch diameter telescope being built for the California Institute of Technology has arrived at Pasadena after an ocean voyage from the East by way of the Panama Canal. It is the lower end of the telescope tube, weighing 19 tons, which will eventually be the containing unit for the block of glass soon to be shipped from the Corning Glass Works.

Los Angeles and Pasadena, with their proximity to Hollywood, have seen queer sights, but few more strange than the great wood-crated telescope unit being hauled slowly through the streets. It looked like some gigantic cheese, projecting over each side of the trailer by more than five feet.

The trip from San Pedro harbor to the laboratory at California Institute of Technology took five hours, an average of only five miles an hour. Only the widest streets could be used. Three more hours were spent in maneuvering the trailer up a ramp and around close clearances, with sometimes only three inches to spare, into the huge room where the frame is to be used first as a cell to hold the great glass disk while it is being ground and polished on the 100-ton machine built especially for the purpose.

Once inside the grinding room, further skidding over greased steel plates was unnecessary. A great crane already tested with 60-ton loads picked up the unit and put it in place.

After serving as a holder for the glass disk during the mirror grinding, the frame will be moved to Mount Palomar, where the new observatory is being built. In the meantime, however, the rest of the telescope must be constructed.

Next job in making the world's largest telescope is to finish the grinding machine by the time the glass disk arrives from the East so that the tedious and long optical work can proceed without interruption.

By the time the optical grinding is finished it is hoped that the observatory buildings and mechanical parts will be completed so that the whole instrument can be put into service. Several years will be needed for the whole plan even if all goes well.

ELIMINATION OF HEADLIGHT GLARE*(Copyright, 1936, by Science Service)*

A NEW optical material which promises to save lives now lost in night driving because of headlight glare is announced by the Land Wheelwright Laboratories of Boston.

Known as polaroid, the new material is also to be used for sun glasses which take away light dazzle without darkening the view, and, even more important, make possible motion pictures in three dimensions that have the optical illusion of depth similar to viewing a scene with the naked eye.

Other uses promised include one-way glass for cross-

court privacy in apartment buildings and brilliant building exteriors that change color as one walks by.

Polaroid resembles a sheet of glass but has the ability to polarize the light which passes through it. Now ready to be produced in unlimited quantities, the new material is the first practical use of what has formerly been a laboratory and research phenomenon.

Polarized light is light which vibrates only in one direction in contrast to the helter-skelter vibrations in the ordinary light ray. Polaroid acts to produce the polarized light. The best way to think of the complicated phenomenon is to regard ordinary light vibrations as a mass of straws tossed up in a wind. They are blown against a picket fence. All straws are stopped except those parallel to the slats in the fence and all straws coming through are lined up in one direction. The material polaroid acts as the picket fence.

For use in automobiles all headlights would send out polarized light vibrating in one direction and all windshield shields would be "crossed" so that they would not permit such headlight rays to enter and blind the driver.

The light from one's own headlights would strike the ground ahead, be scattered with the destruction of the polarization and hence such light would enter the car and make possible vision down the road just as headlights act now.

The American Optical Company, Southbridge, Mass., has been licensed to manufacture the new sun glasses, and the Eastman Kodak Company will produce polariscreens, a special form of the material, which will make possible movies with depth.

The three-dimensional motion pictures are taken with a double camera having two lenses as far apart as the human eyes. When such films are shown the two views are projected on the same screen through polarizing sheets set at right angles to each other. The audience, supplied with glasses fitted with clear colorless polarizing lenses set at corresponding angles, sees one image with the left eye, the other with the right and gets the effect of actual presence at the scene. The world's first three-dimensional color movies have already been produced with the system.

For use in sun glasses the lenses of polaroid material discriminate between glare which is polarized and useful illumination which is not so cuts off completely the glare without obscuring the view.

COAL GASIFICATION

IN Siberia and in North Caucasia USSR mining engineers are burning coal mines underground for their gas content. Suggested by the famous British chemist, Sir William Ramsey, before the turn of the century as the most economical way to use coal deposits of the lower grades, the scheme of coal gasification project has been little used elsewhere in the world outside of Russia.

Sir William argued logically that for many purposes it was wasteful to dig mines and extensive cross shafts,

and men down to dig out the coal, ship it hundreds and thousands of miles and finally burn it to make coal gas for illumination, cooking and power. He recommended setting a coal deposit on fire and then by controlled draft and flues lead away the coal gas to the surface.

According to Russian tests the labor spent on the gas is only from one tenth to one sixth of that needed in mining. Moreover, it is possible to obtain gas from very narrow sheets of buried coal which would be unprofitable to mine in the ordinary sense.

In the process of burning coal beds for their gas content, a shaft is dug down to the coal and exhaust outlets sunk in other places over the coal deposit. The coal is ignited at the main shaft and air forced down to sustain combustion. The fumes from the burning coal are sucked out from the exhaust pipes only partially burned. There is much carbon monoxide present, for example, which can be piped to the site of use, or used by industry near the coal gas source.

The method of gasification has been discussed in the past in the United States as well as in England, but practical mining men believe it impossible to control the fire in such a way as to produce a useful fuel gas and that there would be a very great loss of coal as well as hazards introduced if men had to work underground adjacent to the fires. However, these experiments will be watched with great interest by American mining engineers.

THE PREVALENCE OF SILICOSIS

MORE than one million Americans are exposed to silica dust, the condition which may cause silicosis, sometimes called "miners' phthisis" or "miners' consumption," according to estimates of the U. S. Public Health Service.

Silicosis may affect not only workers engaged in rock cutting, as in the cases reported from Gauley Bridge, W. Va., which are attracting Congressional notice, but also those in the pottery, foundry, sand-blasting, abrasive, granite, tool and ax grinding, glass, slate, silica grinding and mining industries.

Not all those exposed to the dust get the disease, however. Probably one fourth of any large group exposed to the dust at any one time have silicosis, and most of those have it in the early stage. Very few people die of silicosis. Silicosis patients usually die of some infection, particularly tuberculosis, to which they are especially susceptible.

Men having silicosis in the first stage of the disease have slight or no disability and may never have any disability, if placed in suitable surroundings. This does not mean that they must necessarily change their occupation. The surroundings in which they work can be made "suitable" by eliminating the silica dust from the air in which they work, or by reducing it to a safe limit. Men suffering from the disease in its second stage can improve materially, and even those suffering with the third stage of the disease can improve somewhat in "suitable" surroundings. The federal health service knows of no industry at the present time where the conditions causing silicosis can not be controlled.

In silicosis the lungs, instead of being spongy tissues with plenty of space for the air to circulate, become

mottled with patches of fibrous tissue which is dense and prevents the passage of air. As the disease progresses, the patient has less and less normal lung tissue for breathing. Shortness of breath on exertion and sometimes a cough are the first symptoms of silicosis. In the early stages, however, the patients often do not know that they have the disease. They feel all right and are able to go on working and living normally. They even may and frequently do gain weight. It is when tuberculosis or some other infection sets in that the patients begin to lose weight and feel badly.

To prevent silicosis the U. S. Public Health Service recommends a combination of measures, no one alone being successful. These preventive measures are: methods of control of the dust at its source; good ventilation to dilute the amount of silica dust in the air, and physical examinations of the workers at the beginning of employment and periodically thereafter, to detect the presence of silicosis, and, even more important, of tuberculosis.

Conditions in practically all the silicosis-producing industries are definitely improving, according to the U. S. Public Health Service, but the surface has only been scratched and there is much dust yet to be controlled.

ITEMS

GOLDFISH have their color preferences. They like blue, Dr. N. Mookherji found from experiments reported to *The Indian Journal of Psychology*, published in Calcutta. The fish were allowed to pick their favorite color by making a choice of four stalls into which they might swim. Each stall was lighted by a candle shining through a piece of colored glass. The number of times the fish entered each stall and the lengths of time they lingered there were counted and tabulated. Blue was the favorite, and then came green, yellow, and red in that order.

REDUCTION in the cost of helium treatments for asthma is now possible through improvement in the method, according to an announcement made by Dr. Alvan L. Barach, of the School of Medicine of Columbia University. Dr. Barach is the originator of the method by which patients suffering from severe asthma are given relief by inhalation of a mixture of oxygen and helium. Because helium is a very light weight gas, it requires only half the effort to breathe the oxygen-helium mixture as to breathe ordinary air. This gives the patient's breathing muscles considerable relief and rest. While not a cure for asthma, the helium treatment has been found an effective remedy in combination with adrenalin. Helium, however, is an expensive gas, so only a few patients could get the benefit of the treatment. Dr. Barach now announces a method of re-using the helium, thus reducing expense. After the gas has left the patient's lungs it is circulated through soda-lime and returned to the apparatus to be used again.

Erratum: In the science review of the year by Science Service, printed in the issue of SCIENCE for January 3, it should have been stated that the ornithological expedition which made permanent records of the songs of birds in the south was under the auspices of Cornell University and the American Museum of Natural History.

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW TOOTH ANESTHETIC

(Copyright, 1936, by Science Service)

DRUG stores were doing a rushing business in New York in thymol, sulphuric ether and ethyl alcohol as dentists began making the new Hartman formula which takes the pain out of tooth drilling.

Announced by Professor Leroy L. Hartman, professor of dentistry in the Columbia University School of Dental and Oral Surgery, the new pain-killer is applied to the dentin of a tooth, lying just below the enamel, and makes possible drilling of a cavity without feeling on the part of the patient.

Here is the formula which Professor Hartman gave out before 3,000 of his fellow dentists at a joint meeting of the First and Second District Dental Societies of the State of New York. Formula by weight: Thymol, 1½ parts; ethyl alcohol, 1 part; sulphuric ether, 2 parts.

The solution is kept in a brown bottle and applied directly to the dentin by a moistened pellet of cotton. The pain-killing effect lasts one hour if the cavity is kept dry by the use of a rubber dental dam. If saliva dilutes the solution the effect may last only twenty minutes. But because the local anesthetic is designed to kill pain only during drilling, the time is ample. A seventy-five cent bottle of the Hartman formula is sufficient for 200 applications.

Sufferers from toothache are doomed to disappointment if they rush to the nearest drug store, have the solution prepared and apply it directly to an aching tooth. It must be placed in contact with the dentin inside the tooth and not on the outer enamel for its pain-killing effect.

As a matter of fact, the discoverer of the formula and officers of the dental society warned: "In the interest of public welfare we warn the public against attempting to use this preparation for the self-treatment of toothache. It is effective when used by a dentist under the proper conditions."

The only possible condition where the solution might aid a home sufferer temporarily would appear to be in the case of a large cavity in a tooth where the dentin is exposed and the outer enamel broken away.

With a sure means of preventing pain during drilling, however, many persons who dread the dentist's chair should feel more like visiting their dentist regularly. A drug manufacturer has already begun the preparation of the tooth desensitizer for distribution to dentists of the nation.

Out of 500 volunteer cases which Professor Hartman has treated the only times the solution failed to do its work was when it came in contact with phenol, or carbolic acid, which is commonly used in dentistry to sterilize a cavity. The phenol must be removed from the cavity or else several applications of the Hartman solution must be applied to dissolve the phenol.

THE TREATMENT OF DIABETES

THE "most valuable discovery in the treatment of diabetes since the original discovery of insulin" is announced in the *Journal* of the American Medical Association.

A new preparation—protamine insulinate—is the answer found by Danish investigators to the problem of the many persons with a severe diabetes which can not be controlled satisfactorily with insulin alone.

Protamine insulinate does not supplant ordinary insulin in the treatment of diabetes but serves as an adjunct to it. The two must usually be used in the same patient at different times each day.

For example, a person with diabetes can employ the quickly acting old insulin in the morning with a heavy breakfast and the slowly acting compound at night before a light dinner.

That is what has been done at the Steno Memorial Hospital, Copenhagen, where Dr. H. C. Hagedorn and his associates have developed the new preparation. A similar procedure is being followed by Dr. Howard F. Root and associates at the New England Deaconess Hospital, Boston, where the new preparation is also being tested.

"It would appear as if a new revolution in the treatment of diabetes must follow and the possibility created for the diabetic patient to resemble more closely a normal individual," writes Dr. Root and his co-workers, Drs. Priscilla White, Alexander Marble and Elmer H. Stotz.

"While the majority of persons with diabetes are able to adjust their carbohydrate metabolism satisfactorily by the injection of insulin several times a day, many have so delicately balanced an equilibrium that it is readily disorganized by slight overdosage or underdosage of insulin," the *Medical Journal* explains. "Wide fluctuations in blood sugar occur in these patients." The Danish investigators have combined insulin with protamines, which are elementary compounds of amino acids containing one or more of the substances lysine, arginine and histidine. The resulting compound is relatively insoluble and tends to be absorbed slowly and over a longer time than ordinary insulin. The blood sugar lowering effect lasts about twice as long.

In presenting the work of both the Danish scientists and of Dr. Root and his associates in Boston, the *Journal* emphasizes several facts: Protamine insulinate is still a laboratory preparation and is not yet commercially available; the compound is somewhat inconvenient in that it must be prepared shortly before use, as it is stable at most for only a few weeks; it does not supplant insulin but serves as an adjunct to it; it is of no special value to persons who are now adequately treated with insulin.

Fifteen cases treated in Boston in general confirm the excellent results reported in the eighty-five cases reported from the Danish hospital.

USE OF ATOMIC "BULLETS" IN BIOLOGICAL RESEARCH

(Copyright, 1936, by Science Service)

BIOLOGICAL research, including the study of cancer, as well as physical science should benefit in the experimental program to be undertaken with the newest of all atom accelerators, just put in operation at Cornell University by Dr. M. Stanley Livingston, instructor in physics. Parti-

cles with 2,000,000 electron volts energy can be generated. Eastern leadership in the field of the conquest of matter is assumed by Cornell, according to a statement given out by the university, with the new device which is patterned after the famous 85-ton cyclotron equipment of Professor E. O. Lawrence, of the University of California.

Dr. Livingston was a co-worker of Professor Lawrence in the design and construction of the West Coast apparatus, which has done so much for increasing knowledge of artificial radioactivity, the production of penetrating neutrons and studies on the transmutation of the chemical elements.

Besides investigations into the structure of the nuclei of atoms, it is planned to use the apparatus to test the effects of neutrons which it will generate on mouse cancers, in cooperation with the New York State Institute of Malignant Diseases at Buffalo, N. Y.

In cooperation with other departments of the university, research is planned also on the effects of neutrons on plants, particularly on fern spores, and on the eggs of some of the lower forms of animal life. A comparison will then be possible between the neutron's effects and those of x-rays and the gamma rays from radium. Biologists too would like to see if the high-velocity neutrons from the apparatus can cause visible changes in the chromosomes which carry the pattern of animal make-up within them. Also scheduled for investigation are the possibilities of mutations or gene changes caused by the piercing neutrons.

The biological applications of the research hold promise because of all the elements bombarded by other investigators with neutrons, hydrogen appears to have nearly the greatest stopping power. And the animal body contains large amounts of hydrogen, both in the form of water and other more complicated chemical compounds. Neutrons therefore are expected to have striking and appreciable effects on such tissues.

Weighing 6,500 pounds, the apparatus takes charged cores of hydrogen atoms and accelerates them within a pancake-shaped vacuum chamber lying flat between the pole pieces of a powerful electromagnet. Issuing near the center of the pole pieces, the particles travel in an ever-widening spiral parallel to the faces of the magnet's pole pieces. Twice during each trip around the particles receive a boost of electrical voltage which drives them faster and faster. The cumulative effect finally ends when the particles reach the periphery of the apparatus and they have been given energies of 2,000,000 electron volts by the series of electrical kicks.

When at their greatest velocity and energy they are picked off and directed against targets, which undergo a variety of effects, including transmutation and artificial radioactivity. In the process of impact, particles torn from the nuclei of the targets' atoms come off, and among them are the neutrons.

Describing the action of the apparatus, Dr. Livingston says: "The action may be compared with that of a swing which, starting from a period of rest, increases its arc with each to-and-fro movement. In both instances—whether swing or vibrating "bullet"—perfect rhythm is at once established. Regardless of the arc which the

swing describes, the time interval required for it to pass through its starting point is the same. So it is with the semi-circles described by the atomic "bullet." In each excursion, regardless of an ever-increasing radius, the oscillating "bullet" reaches the gap separating the two disks in a period of time which is constant. It is this physical principle which gives to the apparatus its resonance feature."

NORTH AMERICA BEING PULLED INTO THE PACIFIC OCEAN

NORTH AMERICA is being pulled into the Pacific Ocean by the attraction of the dense layers of the earth's crust which are below the bottom of the Pacific. This in substance is the conclusion of an investigation reported by Dr. Ross Gunn, of the U. S. Naval Research Laboratory.

The movement results in a great thickening of light material on the forward edge of the moving continent, which well accounts for the growth of mountain ranges like the Sierra Nevada in the Pacific coast states, adds Dr. Gunn in his report to *The Physical Review*.

Measurements on the velocity of sound waves indicate that layers under the Pacific Ocean have a density greater than similar layers underlying the continents. This dense mass of material produces a component of gravitational force at an angle to the normal vertical pull of gravity.

It is this sidewise, or tangential, pull of gravity which is tugging North America gradually westward, according to Dr. Gunn's findings.

The geophysical evidence, Dr. Gunn maintains, substantiates his earlier papers concerning the origin of the solar system. Dr. Gunn has shown that a star can acquire sufficient angular velocity to split into two parts. As the parts separate, while revolving around one another, enormous tidal forces are set up which cause both parts of the original star to lose pieces of themselves that eventually become planets. These planets, as they fly off, are hotter on one side than on the other.

It is this difference of temperature, Dr. Gunn has maintained, which ultimately accounts for the uneven distribution of the continental and oceanic hemispheres of the earth, the lopsidedness of the earth's magnetic field and the uneven distribution of the density in the various layers of the now-cooled earth's crust.

It is the last point, the much greater density of the earth's crust beneath the Pacific Ocean, that accounts for the tangential gravitational force that moves North America westward.

Tangential forces in regions of sedimentation and crustal weakness, explains Dr. Gunn, cause overthrusting of the outer layers. The overthrusting ultimately results in the observed mountain changes.

DRY-ICE REFRIGERATION

WIDE use of domestic refrigerators served with dry-ice is forecast by H. S. Cornish, refrigeration engineer of Los Angeles. This comparatively recent development formerly thought to be prohibitively expensive, is now attracting attention since the price of dry-ice, or solid carbon dioxide, has fallen much below five cents per pound even in small quantities.

In the present market it is still conceded, however, that household refrigeration with dry-ice is substantially higher in cost than common icebox service under city conditions, at least for customers whose requirements are met by ordinary ice. Out in the California deserts, however, there are many locations where both ice factories and electric power are missing. The dry-ice box then scores an economic advantage.

In new models described by Mr. Cornish the dry-ice is placed in a special insulated compartment, an icebox within an icebox. In view of the extremely low temperature of dry-ice at common atmospheric pressure, 109 degrees below zero Fahrenheit, a high-grade non-conductor of heat is required in the compartment walls. Otherwise the contents of the main refrigerator would be frozen with astonishing rapidity. It happens that carbon dioxide has remarkably high vapor pressures in the solid state, causing rapid escape of vapor and great power of withdrawal of heat. A great contrast between dry-ice and common ice is noted, the former having a vapor pressure of about 75 pounds per square inch at its melting point, whereas common ice rates at little over one ounce per square inch.

At one point on the bottom of the inner compartment an aluminum plate with projecting fins or knobs is inserted in place of a small section of insulating wall. The inward transfer of heat through this plate is neatly adjusted so that the main chamber is cooled to temperatures in the range of 35 to 45 degrees Fahrenheit. Should the temperature run under 35 or over 45, the velocity of evaporation of the dry-ice will be automatically increased or decreased.

ITEMS

A WHITE elephant with pink eyes—a true albino animal—was killed not long ago by a game warden on the plains of Laikipia, in Kenya Colony, Africa. Like all "white" elephants, the animal was in reality only a dirty gray in color, but every hair on its body was white. The Kenya game warden's report relates terrible effects on wildlife of three years of drought. There are records of elephants falling into wells and perishing because they were too weak to get out again. A number of rhinoceroses and many buffalo have also died in their frantic efforts to get water. In northern Kenya, herds of wild elephants hid behind cattle while natives dug for water, and when it was found stampeded forward to get the first drink.

EVIDENCE tending to show that man existed in North America before the Ice Age is announced by Professor Paul MacClintock, of the department of geology of Princeton University. The evidence is reported to be human implements found in the White River region of South Dakota and Nebraska and deposited there before the time of the great glacier. Assisted by Justus S. Templeton, a Princeton senior, Professor MacClintock discovered last summer varved sediments in the bed of an extinct lake formed when the valley of the White River was dammed by the last advance of the ice sheet. Knowing that these sediments must be contemporaneous with

the ice sheet, they figured that man-made artifacts found in or below the lake sediments would prove that man was there before the ice. Accordingly, aided by geologists from the Nebraska State Museum, they dug below the sediments and found not only many artifacts, but scores of hearthpits containing charcoal, burned stones, and burned bones of extinct animals. The pits, which are two or three feet wide and one or two feet deep, seem to have been used to preserve the fire from day to day. While no skeletons of the ancient people have yet been found, hopes are held for excavations in coming seasons.

ASTRONOMY and cooking marched hand in hand during the three years' research which led to the development of the ultra-low expansion type of glass that was used by the Corning Glass Works in the great 200-inch diameter disk of glass for the new telescope of the California Institute of Technology. Astronomy obtained the disk for the telescope mirror out of investigations in which 1,500 different kinds of glass was studied. Housewives will benefit from the same work, for one of the new glasses is now being used for a new type top-of-the-stove glass cooking utensil. What makes ordinary glass crack when heated suddenly or unevenly, indicates Dr. J. C. Hostetter, who had charge of making the great telescope disk, is the large coefficient of expansion which sets up unequal stresses that finally pull the glass apart.

CONSTRUCTION of the world's first "cotton runway" will be undertaken next spring at the Newark, N. J., Airport, it is announced by the Cotton-Textile Institute. Cotton sheeting is already in use in the South in rural and secondary road construction where traffic is light. It is found to minimize erosion, cracking and wrinkling. The cotton sheets act as a binding layer between the highway base and the top dressing. It takes from six to eight bales of cotton to construct each mile of an 18-foot road by the method. The Newark airport installation will amount to about one mile and a half of such road.

DECAY of the teeth with attendant toothaches may be prevented if a method developed by Dr. E. P. Brady, of the Washington University Dental School, is put into successful practise. A dental examination can determine by a chemical test which of the teeth in one's mouth are liable to decay. Silver nitrate, a common drug used generally for germ killing purposes, betrays the presence on the tooth enamel of certain faults of formation. It is in these faulty areas that decay is likely to start, because there the acids in the mouth and acid-producing bacteria can penetrate through the enamel to the sensitive dentine beneath. The decay can be prevented by the use of silver nitrate. After it has started, its progress can be stopped by use of another chemical called trichloroacetic acid, Dr. Brady said. This substance acts to coagulate the organic material in the tooth and block any further penetration by the acids of decay into the interior of the tooth. Nature has her own way of doing just this, under favorable conditions. When decay starts, a defense may be made in the form of a barrier of calcium deposit across the path of the penetrating acids.

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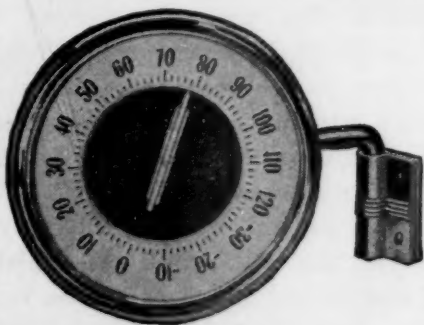
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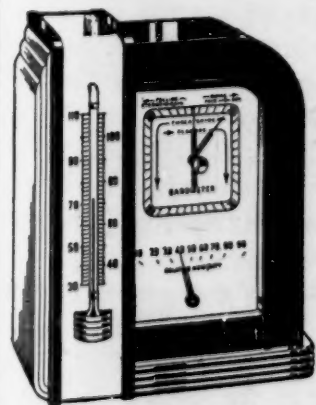
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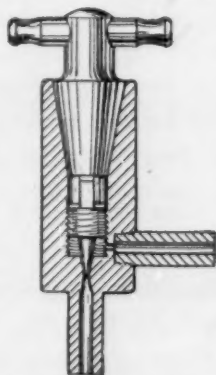
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SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS READ AT THE ST. LOUIS MEETING OF THE AMERICAN ASSOCIATION AND ASSOCIATED SOCIETIES

THE new super-penetrating eye of science that pierces palls of haze and smoke, which was demonstrated before the American Association for the Advancement of Science by Dr. V. K. Zworykin, of the Radio Corporation of America, will have its first use in the quiet confines of a biological laboratory, searching out new facts about life processes. The new device, which looks like a telescope from the outside, does its seeing by the infra-red rays that the unaided eye can not see. The heart of the new infra-red "eye" is a thin film of caesioted oxidized silver, deposited on a metal plate. This substance is specially sensitive to infra-red light, from the lower limit of visibility, at about 800 Ångstrom units, down to about 10,000 Ångstrom units. When the infra-red image of some object, either giving off infra-red rays itself or reflecting them from an infra-red searchlight, is focused on this special film, it gives off a stream of electrons from all the lighted parts of the image. These shoot up a tube, passing through a series of electrically charged rings, which bends them as a lens bends light. This part of the apparatus Dr. Zworykin calls an "electron lens." The focused stream of electrons, now arranged in image form again, though still invisible, strikes on a second screen, this one covered with a fluorescent substance, working on the same principle as the ordinary fluoroscopes used in hospital x-ray rooms. This turns the invisible electron image into a visible light image, very clear and distinct. The process is thus summed up in three steps: first, the infra-red rays from the object itself; then, the translation into electrons; finally, the second translation of electrons into an image shown in visible light. The uses of the new infra-red "eye," in both peace and war, are manifold, though the usefulness of the device is limited to conditions under which infra-red rays will travel through the atmosphere. Infra-red will easily penetrate haze and smoke, but fog stops it because the water-particles in fog are too big to let the rays pass. They might get through very thin fog, but the real fog menaces to air and sea navigation are still baffling.

COSMIC rays promise to measure immense movements of astronomical masses in the universe and also to test a new and needed Einstein-like extension of electrodynamics to high energies and powerful electric fields, above 70,000,000 electron-volts, which cosmic rays themselves have revealed. These two new future uses of the rays were predicted by Dr. Arthur H. Compton, University of Chicago, in an address before the association and the American Physical Society. "Studies of the latitude effect and of the variation of cosmic rays with time of day confirm our belief that the rays come from very remote distances," Dr. Compton said. "There is some evidence that the motion of the earth with the rotation of the Milky Way affects the rays. If this preliminary indication proves

correct, it will mean that the rays come from very remote distances indeed, and they will serve as a useful source of information regarding astronomical motions." Dr. Compton explained the need of new physical theory and how the cosmic rays may help. "One of the most important recent developments in the study of these rays is the fact that electrons with such high energies do not excite as much radiation as is required by present electrical theory. The experiments are in reasonably good accord with the theoretical predictions up to about seventy million electron volts, at which the wave-length of the electron as calculated on quantum theory becomes about equal to its radius as calculated from classical electron theory. At higher energies the action of the electron departs rapidly from the predictions. This means that an extension of present theory of electrodynamics is needed for the regions of strong electric fields, which will be comparable with the extension of Maxwell's electrodynamics introduced by Lorentz and Einstein for the condition of high velocities. If and when such an improved theory is developed, cosmic rays afford one of our very few possibilities for giving it an adequate test."

THE atoms of the air are exploding one by one and filling the room where you sit with showers of their fragments. The projectiles causing those atom explosions have traveled millions upon millions of miles across interstellar space. These facts, almost taxing one's credulity, were established in the latest cosmic ray research in a mountain top laboratory on the summit of Pike's Peak. Dr. Carl Anderson and Dr. Seth Neddermeyer, of the California Institute of Technology, reported their findings before the meeting of the American Physical Society. To study the effect of cosmic rays having greater disintegrative power than those found at sea level, Drs. Anderson and Neddermeyer took, by truck, several tons of apparatus from Pasadena to Pike's Peak. Working night and day they packed a year of experimental measurements into a few months' work. Using Dr. Anderson's Wilson Cloud Chamber apparatus, already famous as the equipment wherein the positron was first discovered, they made over ten thousand photographs of the atom explosion tracks caused by cosmic rays. Evidence was found indicating that many of the tracks were caused by a heavy type particle. The terrific speed with which the atomic fragments were ejected in some cases represented more energy than could come from the nucleus of the struck atom alone. The fragments must, therefore, take up some of the energy of the incoming cosmic ray.

EXPERIMENTAL evidence for the existence of the "neutrino"—postulated but never-found new atomic particle—was presented by Dr. Kenneth T. Bainbridge, of Harvard University, before the American Physical Society.

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For years investigators have known that the cores, or nuclei, of atoms contained the electrons, the negatively charged particles of small mass, and the protons, which are positively charged particles of the same mass as the hydrogen. In 1932 Professor James Chadwick, of Cavendish Laboratory, England, discovered that atom nuclei also contained the neutron, which, as the name suggests, is neutrally charged in the electrical sense. Professor Chadwick won the 1935 Nobel Prize in physics for this discovery. More recently a number of theoretical scientists have postulated the existence of the neutrino, or little neutron, in order to explain certain products produced in artificial radioactive transmutation of the elements. Working from known facts and with known theories it can be shown, for example, that certain isotopes can exist only if the neutrino is a fact instead of a mathematical abstraction. The search for such isotopes would, then, constitute a test for the existence of the neutrino. Dr. Bainbridge's report concerned the discovery of what might be called the "neutrino" isotopes. Using his new mass spectrograph—which might be likened to a super scale for weighing individual atoms—isotopes of cadmium and indium of atomic weight 113, indium and tin of atomic weight 115 and antimony and tellurium of atomic weight 123 were detected. These isotopes can exist only if the neutrino exists.

EXPERIMENTAL rocket flight to altitudes of 7,500 feet, with speeds up to 700 miles an hour, were reported by Professor Robert Goddard, of Clark University. Motion pictures of his rockets in actual flight were shown and some of the tests which Colonel Charles A. Lindbergh and Harry F. Guggenheim saw last September at Roswell, N. M., were shown on the screen. The experimental flights, based on five years of research, are designed to provide science with a mechanism for probing the stratosphere beyond the reach of balloons, either manned or without human pilots. Flights to the moon and other astronomical objects have never been considered by Professor Goddard as a goal in his experiments. Three needs for rocket research were cited: (1) A suitable combustion chamber which can withstand the high temperatures and pressures encountered when the rocket fuel is burned; (2) a means of keeping the rocket in vertical flight; (3) construction of very light-weight rockets. The first two goals have been achieved, Professor Goddard pointed out. A rocket "motor" has been perfected which yields 209 horsepower per pound of combustion chamber. A good airplane engine for comparison will give slightly less than one horsepower per pound of weight. Stabilization in flight, according to Professor Goddard, is accomplished with a gyroscope which serves to move vanes placed in the flaming blast of the rocket.

Two chemical conquests, one the isolation of an alcohol which is the essence of the anti-sterility vitamin E and the other the identification of the cause of one of the puzzling virus diseases as a non-living crystalline protein material, are of special interest. Dr. Herbert M. Evans, of the Institute of Experimental Biology of the University of California, announced that from the oil of the

germ of the wheat kernel he and his co-workers, Drs. Oliver H. Emerson and Gladys A. Emerson, have isolated an alcohol, called tocopherol, which has the properties of vitamin E. Since Dr. Evans was the discoverer of the anti-sterility vitamin E in 1922, his latest achievement completes a cycle of research giving the world of science a very complete record of this food factor that is essential to reproduction along with vitamin A. Vitamin E occurs in wheat and lettuce most abundantly and its lack causes sterility through interference with development of the baby in the female and the degeneration of sex glands in the male. By demonstrating that the infective material in the typical virus disease, tobacco mosaic, consists of non-living crystals, Dr. W. M. Stanley, of the Rockefeller Institute for Medical Research, at Princeton, N. J., has probably opened a new field of medical research. While Dr. Stanley has obtained his results on a plant disease instead of a human ill, his colleagues expect that some of the important diseases of mankind caused by what are called "viruses" will prove to have a chemical, inanimate cause. Dr. Stanley described just how he concentrated the infective virus material of a disease that hampers tobacco production and obtained from it crystals of a protein which had the power of causing the disease. Proteins consist of a class of substances that occur most abundantly in meat, cheese, etc., among foods. The fact that the material obtained is crystalline indicates it is a pure chemical.

A MEASURING stick for resistance to colds and possibly pneumonia seems to have been found in the capacity of the body to work. Experiments indicating this were reported by Dr. Arthur Locke, of the Western Pennsylvania Hospital Institute of Pathology, Pittsburgh. This does not mean that hard workers are necessarily the most resistant to colds and pneumonia, Dr. Locke explained. It is the body's ability to do work, rather than the person's inclination to work, that is important. Dr. Locke sees resistance or defense against invading disease "germs" as an activity that involves work. "Every phase of the activity which is necessary for the support of life requires an eventual expenditure of work," he said. Rabbits able to perform quickly the simple task of warming up after chilling are also able quickly to get invading pneumonia germs out of their blood, he found. This warming-up time is a good index of the rabbit's resistance, but it is not a practical measure of man's resistance. Instead, Dr. Locke uses for the measuring stick on man the amount of oxygen consumed in a minute while the man is riding a bicycle as hard as he can. The work on men has only just begun. Already, however, Dr. Locke found that persons who use about two quarts of oxygen—2,000 CC—in a minute during hard work have fewer and less severe colds than those who use less than this amount of oxygen. Because he has been able to study only 39 people during two months, Dr. Locke hesitates to draw any definite conclusions.

ONE of the problems of childbirth has been solved by discovery that two of the female sex hormones act as the

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trigger that sets in motion the process of labor. Dr. G. F. Marrion, of the University of Toronto, reported the solution of a riddle puzzling medical scientists, by finding that just before, during and after labor great quantities of active sex hormones flood the mother's body. The hormones are known as oestrone and oestriol. During the time that the baby is growing before its birth, the hormones are produced continuously but in ineffective forms. Dr. Marrion found that in the inactive form the hormones are bound up with a kind of sugar, glucuronic acid. When the time for birth comes this combination is broken.

Two poisons that cause many deaths each year, through suicide or accident, can now be combatted by physicians through new treatments. The two poisons are the extremely deadly cyanide and the less deadly barbiturate sleeping powders, such as luminal and veronal, which nevertheless cost hundreds of lives when taken accidentally or wilfully. Pierotoxin is the drug that fights overdoses of the sleeping powders. Dr. Theodore Koppányi, Georgetown University Medical School professor who developed the treatment, assisted Washington physicians in recalling from otherwise certain death persons who had taken overdoses of the powders with suicidal intent. Cyanide poisoning is combatted in a new way by Dr. K. K. Chen, of Indianapolis. He uses a mixture of amyl nitrate, sodium nitrite and sodium thiosulphate and this trio of drugs rapidly counteracts the deadly poisonous effects of the cyanide when administered by injection into the veins.

CHEMICALS that produce cancer in man and animals also cause abnormal tissue growths when applied to plants, Dr. Michael Levine, of Montefiore Hospital, New York City, told the meeting of the American Botanical Society. Dr. Levine used a number of substances, including the well-known cancer-provoking coal tar and compounds containing the "sulfhydryl" group, claimed by some physiologists to be especially liable to cause abnormal cell formation. He applied them to the growing tips of a considerable variety of plants, both annuals and perennials. Young sunflower plants thus treated grew crooked stems, the spaces between the leaves were shortened, many small branches were formed producing a "witch's broom" effect. Injured or injected stems painted with chemicals or treated with powdered forms of these agents produced swellings with small tumor-like growths. Under the microscope, these abnormal growths displayed certain cancer-like appearances, but of the simplest type. The plant tissues did not remain permanently cancerous, but developed the characteristics of mature tissue and stopped their wild undirected growth.

TAKE the figure 2 and add 55 ciphers after it and you will have the mass of the universe expressed in grams! That is the report of the Viennese physicist, Professor Arthur Haas. He did not weigh the universe to find its mass, as might seem necessary to the layman. His result was based on theoretical calculations, the interest of which lies in the fact that they were made without the

use of customary helps like the relativity theory, the concept of an expanding universe, the curvature of space or astronomical data. From the same calculations Professor Haas derived the number of particles in the universe and the radius of a spherical volume of space over which astronomical objects are distributed. The number of particles amounts to the figure 12 with 78 ciphers after it. And the radius in centimeters of the volume of space is expressed as 93 with 25 ciphers following.

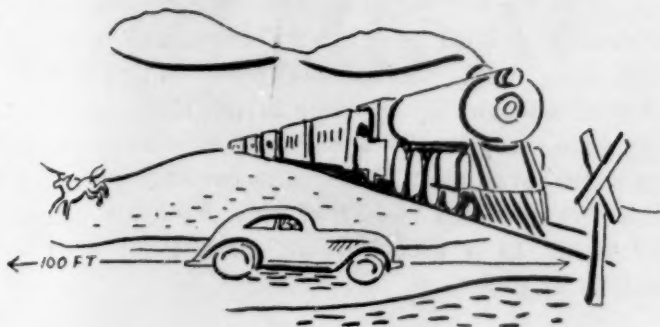
WARNING of a new explosion menace was given by Dr. R. W. Wood, of the Johns Hopkins University. The detonator caps used to set off dynamite blasts are causing damaged fingers and blinded eyes and occasionally deaths when they are found in quarries by children or lost in coal during mining. Dr. Wood recently investigated the mysterious death of a Baltimore woman which occurred while she was stoking the furnace. A cap left in the coal had exploded and a small pellet of copper no bigger than the head of a pin was blasted through her breastbone, severing a large artery and causing death. Experiments made by Dr. Wood showed that the minute projectiles are driven by the explosion through even the thickness of a couple of telephone directories.

THE 23-year period of solar activities, which is the dominant one of twelve solar cycles, not only exists at present but has existed in at least two past geologic ages. Dr. Charles G. Abbot, secretary of the Smithsonian Institution, reported that evidence has been uncovered by paleontologists and geologists that the same slow tides in the sun's energy flowed and ebbed in Pleistocene and Eocene times that are moving to-day. Pleistocene time was the Great Ice Age; Eocene time was the dawn of the Age of Mammals, about 55,000,000 years ago. All the twelve lesser solar cycles are aliquot parts of the 23-year period. In addition, there is a double cycle of forty-six years.

POORER radio reception in the broadcast region of the radio dials is forecast by Dr. Harlan T. Stetson, Harvard scientist, thanks to the increasing spottedness of the sun that will occur in the next two years. Because the sun is becoming increasingly active as measured by the great solar storms, seen as sunspots, there is every indication that the sun will reach a peak of maximum spottedness earlier than the usual length of the familiar cycle that astronomers have been carefully measuring for over a hundred years. Dr. Stetson finds that the next greatest time of sun spottedness will be reached in the early part of 1938, only ten years since the last maximum. Solar activity now is well on towards the half-way mark between the last minimum in 1933 and the next maximum.

ENGINEERS now have a new weapon with which to combat one of their most powerful enemies—the earthquake. A machine devised at the Massachusetts Institute of Technology, and described by Arthur C. Ruge, of the institute staff, makes it possible for them to reproduce at will, on a small scale, all the wracking movements of any earthquake that has been recorded on a seismograph.

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Models of buildings, set on this machine, are given a chance to display points of strength and weakness, and the engineers can turn the knowledge they thus obtain to account in perfecting the resistance of their structures to the thrusts and pulls of an unruly earth. Machines constructed for this purpose in the past have not been able to follow the actual movements of an earthquake at all accurately, due largely to imperfect control mechanisms. Mr. Ruge's device consists essentially of an electromagnetic control over a valve, that in turn determines the rate and amplitude of motion of an oil-driven piston moving the shaking table. The current that operates the control is increased and diminished by a photoelectric cell, or "electric eye," in response to a controlling cam cut out of paper, in the exact shape of the earthquake's record curves. A spot of light constantly "watches" the irregular edge of the cam.

BELIEF that man lived in America hundreds of thousands of years ago was challenged by Dr. Ernst Antevs. Man could not have lived in America more than 20,000 years ago, he said, because ice sheets would have blocked his passage. Only one chance in a million exists that human beings came to this continent at about 20,000 years ago, but no scientific evidence, truly verified, has been found to show that he did. This estimate of Dr. Antevs, based on geological studies of climate of past ages, is much higher, however, than would have been accepted a few years ago. But it discounts the idea that because stone tools of ancient man found in America resemble paleolithic artifacts thought to be 500,000 to 250,000 years old found in Europe, man may have existed in America at such an early time.

FOSSIL remains of the world's largest insect, a prehistoric dragon-fly nearly two and one half feet long that was king of the air about 150,000,000 years ago,

have been found near Elmo, Kansas, by Dr. Frank M. Carpenter, of the Harvard Museum of Comparative Zoology. Although only a part of one wing was discovered, the fact that many other smaller insects of a similar type have been found in excellently preserved condition, has enabled scientists to gauge accurately the size of this entire specimen. The insect was a member of the protodonato group which lived in the Permian Age, about 150,000,000 years ago, when there were no birds or mammals on earth, but only fish, amphibia, reptiles and invertebrates. With long thin bodies and good-sized wings, these insects were the most powerful that ever lived and were undoubtedly supreme in the air in their time. They were exceptionally speedy and were so strong that they could cover great distances in one continuous flight. Their diet consisted mainly of smaller insects, probably cockroaches to a great extent, since these were very plentiful at that time.

PLANTS, complete with leaves and roots, have been grown from almost microscopic bits of plant-embryonic tissue from which such plant parts have not previously been known to develop, says Dr. Carl D. LaRue, of the University of Michigan. The bits of tissue were all cut out carefully, usually from sprouting seeds, sometimes from buds on stems, and planted in a sterile nutrient medium, with a very little of the growth-promoting substance known as hetero-auxin—a concentration of one part in twenty million. From wild lettuce seeds, bits of the primary stem, bearing no trace of roots or leaves, grew successfully in Dr. LaRue's glass containers and produced complete plants with both roots and leaves, which are still living. Corn and oat embryos, removed from their natural source of food in the seed and transplanted to the nutrient medium, have grown and produced roots and green shoots.

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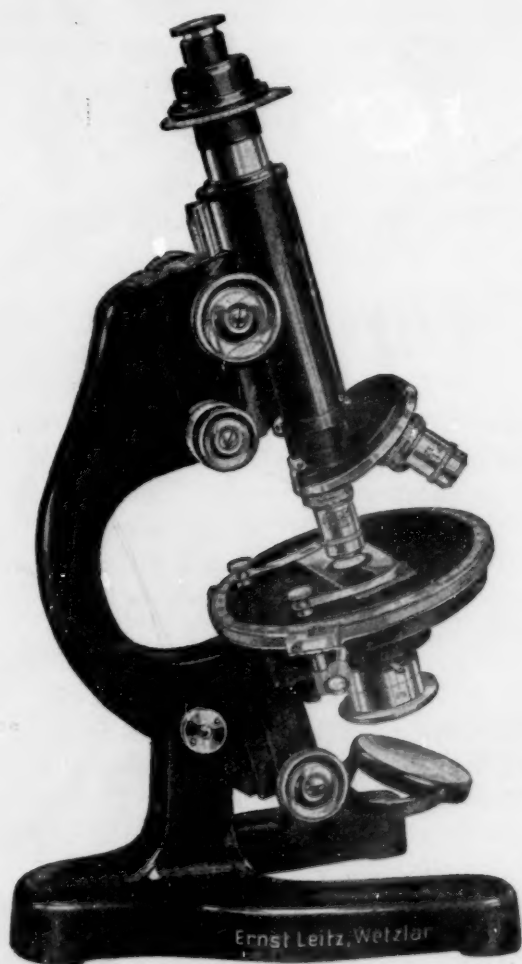
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SCIENCE NEWS

Science Service, Washington, D. C.

RELATIVITY

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THE new theory of relativity, which Professor Leigh Page, of Yale University, suggests, broadens the famous Einstein theory and makes it applicable to the happenings within atoms. In his report to *The Physical Review*, he shows that for atomic events on a microscopic scale either one or the other of the two basic "planks" on which the Einstein "special" theory of 1905 rests must be untenable. Both can not be right and coexist. The new theory does not controvert Einstein in the scale of cosmic occurrences.

Professor Page explains his work as follows:

"The 'New Relativity,' broadens rather than controverts Einstein's theory. It was suggested by the point of view presented by E. A. Milne, of Oxford, in his recent book 'Relativity, Gravitation and World-Structure,' in which the author dispenses with the undefinable concepts of rigid measuring rods and periodic clocks and bases his theory on the concept of light-signals traveling with constant velocity. In its present state of development the new theory is an extension of the special theory promulgated by Einstein in 1905, rather than a modification of his general theory of 1915. Hence its applications are to microscopic rather than to cosmic phenomena.

"The inertial systems of Einstein's special theory constitute a group of reference frames each of which has a Euclidean geometry and a constant light-velocity. These reference frames have constant velocities relative to one another. The significant discovery reported in the 'New Relativity' is the existence of other reference frames characterized by Euclidean geometries and constant light-velocities, which are accelerated relative to one another. If, then, there are no preferred reference systems in an effectively empty region, the laws of nature must be the same relative to the newly discovered reference frames as they are relative to the inertial systems considered in Einstein's theory. In this way the theory leads to the possibility of types of motion not allowed by the older theories, and offers the hope of acquiring a better understanding of the motions occurring in the atom."

THE EFFECT OF HEAVY WATER ON THE HUMAN BODY

A NEW and more precise value than has ever been obtained for the viscosity, or flowing qualities, of "heavy" water has been calculated in a research conducted at Harvard University by Professor Grinnell Jones and Dr. H. J. Fornwalt. Better knowledge of what effect heavy water may have on the body is only one possibility of the research.

Using an automatic timing device instead of the hand-operated stop watch employed for timing in previous viscosity tests, it was found that deuterium oxide, as heavy water is technically known, has a viscosity 23 per cent. greater than that of ordinary distilled water.

Although this figure differs only slightly from the results of other experimenters, who found a value of 23.2 per cent., the new figure is considered of importance in view of the extreme precision necessary in the calculations of modern science. This precise viscosity measurement, for example, may prove to be of considerable importance to physiologists studying the effect of heavy water, which constitutes two hundredths of one per cent. of ordinary water, as found in the human body.

Investigations which have been in progress since the discovery of heavy water in 1934, may also benefit from the more accurate measurements. Outstanding among these are investigations to determine how the fluid affects animals and plants and research seeking to determine the electrical conductivity of the new liquid. It is also expected to aid in checking the possibility that the double-weight hydrogen atom alters important calculations and assumptions made before the discovery of heavy water.

These viscosity tests are similar to others in that the speed of fall of the liquid in a glass capillary tube forms the basis measurement. In early experiments on heavy water, however, observation of the speed of fall was made by the human eye, and the time recorded with a hand-operated stop watch. This method, of course, involves the possibility of inaccuracy on the part of the observer and does not give a satisfactory timing record, since even the best stop watches are accurate to only a tenth of a second.

An automatic timing device, which replaces the human eye with the infallible photoelectric cell, was used in the experiments. Time records were made on a fast-moving chronograph tape which enabled measurements accurate to one hundredth of a second. It is estimated that the possible error can not exceed three or four thousandths of one per cent.

The research was undertaken at the suggestion of Dr. Harold C. Urey, who discovered heavy hydrogen after he had seen Professor Jones' equipment for precise viscosity measurement. Professor Jones is now conducting experiments to determine the surface tension of heavy water, also at Dr. Urey's suggestion. The fluid for both experiments was supplied by Dr. Urey.

THE HARDENING OF SANDY SOIL

(Copyright, 1936, by Science Service)

TURNING porous sandy soil into solid rock-like material with the texture of medium hard sandstone is the latest technique by which European chemists are now strengthening subway tunnels, improving hazardous foundations of buildings, plugging leaks in the beds of streams of valuable mineral springs and restoring underwater dams.

The system, known as the Joosten process of soil solidification, consists of injecting into the soil two chemical solutions which combine to form a gel-like material. The gel material has a high surface tension and acts to draw the sand particles closely together. Loads of 1,100

pounds to the square inch are successfully withstood by the artificially solidified sandy soil.

Applications of the new method are many. The Cathedral Church of Ribe in Jutland rested on closely packed chunks of rock lying on a bed of fine sand. In the course of years and due in part to increasing near-by motor truck traffic, the foundations subsided and cracks appeared in the masonry.

Underpinning the walls with girders was deemed inadequate. It was decided to widen the foundation by means of chemical solidification in the underlying sand layer. The operation was so successful that the menace to the cathedral structure no longer exists.

In connection with recent construction on London's subway system the method was also tried successfully. Injection pipes for the chemicals were driven through the planking used to line the finished part of the tunnel. A chemically solidified arch of smooth gravel was formed in the tunnel's roof. When the time came to cut away parts of the roof which projected into the tunnel profile, pneumatic chisels had to be used because of the strength of the material.

Moreover, the process has been used to plug leaks in a stream of valuable medicinal waters at Teplice-Sanov in Czecho-Slovakia near the Austrian border. The stream bed consisted of sand and silt lying on top of a sandstone layer. Cracks developed in the sandstone and the valuable waters were leaking away.

By putting down injection pipes the chemicals were turned into the sand and silt and brought about successful solidification.

The two solidifying chemicals are reported to be silicic acid, which is put into the sandy soil first, and an unnamed salt solution that immediately reacts with the silicic acid to form an insoluble colloidal silicic acid gel. For successful operation a careful study must be made of the soil type and use confined to sandy layers. The technique will not work for clay or mud.

MODEL OF THE GREAT TELESCOPE

A SMALL telescope, just a tenth the size of the great 200-inch telescope now being built for Mount Palomar, Calif., is being constructed as a miniature "first edition" of the giant instrument with which astronomers a few years hence will extend the limits of the known universe.

This became known when the Observatory Council of California Institute of Technology announced that the giant mounting that will hold and direct at the sky the world's record 200-inch sky mirror will be built in Philadelphia by the Westinghouse Electric and Manufacturing Company. The tenth scale working model will permit rigorous tests to be made in advance of actual construction.

The designs of the mounting are being made by the California Institute, which is also building the working model. The model tests will insure the necessary extreme rigidity of the large instrument, the best type of bearings, guarantee ease and steadiness of rotation of the polar axis, and the perfection of all parts.

After these tests have been made, the engineers of the

Westinghouse company will assist the engineers and draftsmen of the Institute of Technology in the completion of working drawings, for use in their shop.

The scale of the telescope is shown by the fact that the tube, carrying the 200-inch mirror at its lower end, will be about 20 feet in diameter and 55 feet long. The whole instrument must be constructed with great care, not only to serve as a suitable support for the 200-inch concave mirror but also to keep it accurately directed to the stars in their apparent motion from east to west, which is due to the rotation of the earth.

The 200-inch glass disk for the mirror, soon to be shipped from Corning, New York, will be ground, polished and figured in the optical shop of the California Institute. Much of the accessory apparatus to be used with the telescope will also be built in the instrument shop, adjoining the optical shop on the campus.

COLD VACCINE

KEEP a bottle of common cold vaccine in your bedroom. Once a week throughout the winter swallow a dose at night on an empty stomach. This advice for protecting yourself against colds and influenza is given by Drs. David Thomson, Robert Thomson and E. T. Thompson, of St. Paul's Hospital, London. It is based on their researches on oral vaccine for colds and influenza which they report to *The British Medical Journal*.

It is reported that doses of the cold vaccine taken this way since September gave protection against colds and influenza in spite of considerable exposure to these diseases. The vaccine does not produce toxic effects provided it is not taken more than once a week.

The vaccine used is made up of Pfeiffer's bacillus, pneumococci, streptococci and another nose and throat "germ" known as *M. catarrhalis*. Serious colds and influenzas are, in the opinion of the English physicians, usually due secondarily and sometimes primarily to those organisms or "germs."

In their report, the English physicians refer to similar work on the same type of cold vaccine to be taken by mouth which was reported by three American investigators, Drs. George E. Rockwell and Hermann C. Van Kirk, of the University of Cincinnati, and Dr. H. M. Powell, of the Lilly Research Laboratories, Indianapolis. They reported a 70 per cent. decrease in the number of colds contracted by over 400 persons who took the cold vaccine capsule before breakfast once or twice a week through the common cold season.

BOTANICAL PAPERS PRESENTED AT THE ST. LOUIS MEETING OF THE AMERICAN ASSOCIATION

X-RAYS stimulate growth of soybeans, at least a little, if the seeds are treated before planting with short exposures to rays that are not too penetrating or "hard," Theo. P. Long and Professor H. Kerston, of the University of Cincinnati, reported. One variety of soybean, after x-raying of seeds, showed an increase of 2.3 per cent. in total weight of above-ground parts of the plants, as compared with untreated seeds. Another variety showed an increase of 5.9 per cent. Some individual

plots of plants showed as much as 10 per cent. increase after treatment. In general the stimulation "would seem to be real though small," Mr. Long commented.

CHRISTMAS trees in millions of American homes now shed needles all over the carpet, driving harassed housewives to "never-again" vows—which they will certainly break next year, because the children must always have their tree. Christmas trees need not become such a nuisance, Dr. R. H. Carr, of Purdue University, reported. There are chemical means for preventing it. Dr. Carr has kept Christmas trees alive and in full glory of glossy needles and piney odor for as long as two months, by setting the cut ends of their trunks in solutions of certain organic calcium salts. Some other plant parts, like lilac flowers, have been kept in place for a whole year, but the flowers lost their color.

Two months of growth were compacted into ten minutes of natural-color motion pictures, in films shown recently before the meeting of the American Society of Plant Physiologists, by Professor J. C. Ireland, of Oklahoma Agricultural and Mechanical College. The films were taken by the "time-lapse" method, in which an exposure is made once in several minutes, or even in several hours, instead of the usual rate of sixteen a second. When such "time-lapse" films are projected at ordinary speed, the events portrayed are immensely speeded up. In Professor Ireland's films, the scientists could see the effects of four different treatments of growing cotton plants. One was given nothing but distilled water, a second received fertilizer consisting of ammonium nitrate, a third got potassium sulphate and the fourth calcium phosphate. At first, during the early seedling stage, the potash-fed plant sprinted ahead, but later on its phosphate-treated twin staged a remarkable rally. The changes in color of the plants were as striking as the records of their rates of growth.

BORON, an element most familiar in the common household chemicals borax and boric acid, is indispensable for the normal growth of plants. They need only a minute trace of it, but if deprived of that minimum quantity they become very sick. Consequences to corn plants of boron starvation were described by Dr. E. T. Eltinge, of Mount Holyoke College. The plants soon lost their normal green color, their young leaves failed to unroll, their root tips became swollen and stunted, and by the end of three weeks growth had practically ceased.

WE may all soon be eating turnips as a means of getting goiter-preventing iodine into our systems, just as we now eat spinach for the vitamins it contains. Or if we live in the South, we may combine the two benefits in a dish of turnip greens. Dr. Warren B. Mack told of experiments with many kinds of vegetables, to see which would make best use of iodine applied with fertilizer to the soil. He found turnips to be most efficient, increasing their iodine content more than a hundred-fold when plenty of that necessary element was available in the soil.

SPORES of the fungi that cause plant diseases bring

about their own destruction when they come into contact with Bordeaux mixture. How this "suicide" is accomplished was told by Drs. S. E. A. McCallan and Frank Wilcoxon, of the Boyce Thompson Institute for Plant Research. Bordeaux mixture contains copper, and copper is deadly to fungus growth. The spores secrete some substance that makes the copper soluble, and in that state it is active against the spores. Analysis by delicate microchemical methods indicated that the copper-dissolving substance in the spore secretions is malic acid, a compound found typically in apples but present in many forms of plant life.

ITEMS

A NEW theory explaining the long-baffling problem of the apparent dual nature of light which sometimes acts like a particle and at others like a wave motion has been reported to *Nature* by Sir Joseph Thomson. A photon of light, according to Sir Joseph, might well be regarded as a ring of electric force traveling at right angles to its plane. It would be like a ring slipping along a cane; the cane serving as the light ray. This picture of light is extended to consider a photon of light as a series, or train, of such rings. A quantum of light, it is suggested, would be a train of definite length of these electric rings of force that would be given out by an electron in falling between energy levels in an atom. A train of rings would make possible an explanation of the interference of light.

HEAVY WATER, with double-weight instead of ordinary single-weight hydrogen atoms, speeds the growth of ordinary green plants but slows the growth of non-green plants such as fungi. This discovery is announced by Professor A. J. Ewart, of Melbourne University. In his experiments, bacteria and fungi were retarded in growth. Yeast was either not affected at all or was slightly accelerated, although it also is a non-green plant. Oat seedlings and other green plants grew faster. Heavy water did retard green plants at one life stage: it slowed down the germination of seeds. But once they were sprouted their growth was more rapid.

DROUGHT-THREATENED, as well as cold-stricken, areas are in need of a forage plant that can withstand wide ranges of temperatures. After a long search a weed has been found that not only satisfies this condition, but can serve also as good feed under ordinary conditions. It is known as sickle lucerne, and it grows in a large number of types on the steppes of the Ukraine. This weed is remarkable in its endurance, can stand the longest, most devastating droughts, as well as the coldest snowless winters. It grows in sandy, clay, rocky, limy and salty soils. It has a strongly developed fibrous root system running in all directions and making use of the slightest moisture in the soil. In this respect it is said to be far superior to alfalfa. The food value of the sickle lucerne makes it a desirable feed plant. It contains 14.70 per cent. of nitrogen and 3.92 per cent. of fat.

SCIENCE NEWS

Science Service, Washington, D. C.

MATTER IN THE CORES OF ATOMS

PROFESSOR NIELS BOHR, of the University of Copenhagen, at a lecture given at the University College, London, stated that the nuclei or cores of atoms are composed of such dense matter that if the human fist were packed as tightly with matter it would weigh a million times a million tons. It is this close packing of the hearts of atoms which is proving puzzling to investigators, according to Professor Bohr, for the structure and behavior of atom nuclei are governed by laws quite different from those already known for atoms, as a whole, or for familiar matter that can be seen or handled.

A possible explanation for the mysterious explosions of atoms which have been observed in studies of cosmic rays might be found, he suggested, by the impact of particles having energy of perhaps 1,000 million volts. This is a hundredfold multiplication over the mere 10,000,000 volt energy particles available in laboratories. When the particle "bullets" can be produced having the much higher energy, atomic explosions may also be produced in the laboratory. That 1,000 million volt energy particles may be produced is not beyond distant hope, he said.

The nucleus, Professor Bohr suggested, may be likened to a group of billiard balls lying on a circular table with low cushions. If some external ball is shot into the group there starts a series of mutual collisions which may cause the capture of the impinging ball. Such a capture explains the creation of the super heavy element No. 93 by the Italian physicist, Dr. Enrico Fermi.

Another possibility, Professor Bohr pointed out, is that if the balls keep colliding there is a possibility that one of them will collect enough energy to jump the barrier and go off the table. This situation could be likened to the experiments on artificial radioactivity performed first by the latest Nobel prize-winners, Irene Curie Joliot and her husband, M. Joliot.

MAXIMUM AGE OF THE UNIVERSE

THE universe is not so old after all! Flatly contradicting Sir James Jeans's figures of ten million times a million years for the age of the universe, Dr. Bart J. Bok, of the Harvard College Observatory, has found that number approximately five hundred times too high.

Twenty billion years is the upper limit of the age of the universe, as viewed by Dr. Bok. Jeans's long time scale does not fit with the evidence of star clusters, with the known facts of the rotation of the Milky Way system or with the existing theories of the creation of the spiral nebulae. Nor does it explain the existence in the same star cluster of "young" red giant stars and of "old" dwarf stars.

"The giants with their tremendous energy output can hardly have existed for much longer than ten billion years, unless we wish to make the as yet unfounded hypothesis that the energy radiated away is being replenished in some unknown fashion from surrounding space," Dr. Bok said. "We found it unlikely," he concluded,

"that the observed clusters have existed for more than twenty billion years as groups of stars. Lemaitre's theory of the expanding universe indicates that a catastrophe took place a few billion years ago, and it is tempting to place the origins of the stars and stellar systems at the epoch of this catastrophe."

Hundreds of star clusters, including the well-known Pleiades, Hyades and Taurus, would now be on the verge of disintegrating all at once, torn apart by the gravitating forces of the Milky Way, if they had been in existence as long as Jeans believes, according to Dr. Bok.

"In the course of their development these clusters must have wandered through widely different parts of our galaxy, but in spite of this, under Jeans's long time scale we should find them ready to disintegrate, cosmically speaking, simultaneously," he said. "In other words if we were to take our observations at a future epoch removed from the present by only half a per cent. of the total supposed age of our galaxy, no sign of them would be left."

"It seems absurd to assume that several hundred clusters, all of which had presumably considerable mass and density at the time of their birth, would be observed simultaneously on the verge of disintegration in a galaxy for which the conditions that determine the rate of disintegration will be apt to vary from point to point."

LIGHT IN THE NIGHT SKY

THE hiker caught out after dark on a moonless night may feel very thankful for that faint illumination which he calls starlight. But he is wrong in thinking that it all comes from the stars. Only about one fifth of it is of stellar origin. Most of it is produced by particles of electricity, hurled from the sun at enormous speeds, and "striking sparks" as they collide with the molecules of the upper atmosphere.

Professor Georges Déjardin, of the University of Lyons, describes the experiments which have led to the acceptance of this theory in the current issue of the *Reviews of Modern Physics*, published in New York by the American Institute of Physics.

One may wonder how the sun can be responsible for this light when it, itself, is on the other side of the earth. The answer to this is that the electrons are bent around by the earth's magnetic field so that almost as many fall on the far side, where it is night, as fall on the near side. Displays of "Northern Lights" are quite similar to the light of the night sky when examined with the spectrograph, and have, in large measure, the same explanation. The night sky is brighter at times of the year when the northern lights are also most in evidence, according to Professor Déjardin. Some nocturnal light, while also coming from the sun, reaches the earth by another route. Just as sunlight is reflected from the moon this glow is reflected to us from small pieces of matter which fly about in empty space.

The hypothesis that most of the night light is produced in the earth's atmosphere is verified by the fact

that it is stronger near the horizon than directly overhead. When we look straight up, we look through less atmosphere and therefore see less of the light.

Examination of the night sky with a spectrograph shows very nearly what one would expect from collisions of electrons from the molecules of our atmosphere. The photographic plates show abundant evidence of oxygen and nitrogen. These spectra did hold some surprises for physicists, however. The usual oxygen spectrum shows some gaps in its systematic scheme of lines. These gaps have been given the name of "forbidden lines." But in the night sky spectrum these forbidden lines are conspicuously present. After this discovery it was found possible to produce in the laboratory oxygen spectra in which these lines also appear. Most of the light from the nitrogen in the air also comes from a rather rare form of the gas called "active nitrogen." This form of nitrogen has also been produced in the laboratory and appears only when the gas is in a very rarefied state.

Other substances whose spectra can be detected in the night sky include water vapor and argon. The extreme reaches of the upper atmosphere have long been supposed to consist of the very light gases, hydrogen and helium. But the nocturnal spectrograms indicate that oxygen and nitrogen extend as far as the confines of the atmosphere.

INCREASE IN CASES OF MENINGITIS

AN increase in cases of meningitis, with no signs of any let-up, is worrying health officers all over the country. Health authorities do not like to hazard any predictions, but they believe cases of the disease will continue to increase.

The increase seems to have started just a year ago. Reports from state health officers to the U. S. Public Health Service show that the number of cases in the country last year were more than double the number for the preceding year. Reports for the current year indicate that there are now double the number there were last year.

Latest figures available are for the week ending February 8. There were 152 cases during that week, as compared with 101 cases in the corresponding week last year. The cumulative figures are even more impressive. For the first six weeks of 1935 there were 539 cases, and for the first six weeks of 1936 there have been 998 cases. The total number of cases in 1935 was 5,583. The total in 1934 was only 2,295. At the same rate, there will be over 10,000 cases during the current year.

The meningitis now so prevalent in the country is caused by a "germ" called the meningococcus. There is a serum for use in treating the disease which is fairly successful. Preventing the disease, however, seems to depend on isolating the patients and on avoiding crowded living conditions, especially crowded sleeping quarters.

The disease starts very suddenly with a severe chill, headache, fever, explosive vomiting and finally stiffening of the neck. A physician should be called at once and his advice acted on immediately.

Most people, fortunately, are not susceptible to the disease, but an unfortunate feature is the fact that these insusceptible persons can carry the germs without know-

ing it, and it is in this way, chiefly, that the disease spreads.

Control of meningitis, Dr. Adolph Weinzirl, of the Baltimore City Health Department, says, is probably a matter of remedying economic conditions responsible for large numbers of persons living and sleeping under very overcrowded conditions.

No one knows why the disease has increased so markedly in the last year. The factor of crowding was undoubtedly responsible for outbreaks in transient bureau dormitories and camps. It is possible that the disease was spread by healthy carriers from such dormitories to the general population.

PROGRESS IN THE STUDY OF THE COMMON COLD

THE road now seems cleared for the conquest of the common cold, influenza, pneumonia and other diseases of the nose, throat and breathing organs. The achievements of medical science which have cleared such a "possible" road were related by Dr. A. Raymond Dochez, professor of medicine in the Columbia University School of Medicine, at the alumni day celebration.

The common cold and influenza occupy "the key positions in the whole pattern" of infection of the breathing tract, Dr. Dochez has concluded as a result of studies by himself and other medical men. These two diseases are caused by agents known as filterable viruses.

"Each of the agents produces its own characteristic disease, but each carries an added menace in that it promotes infection with those dangerous bacteria that are responsible for the great amount of injury and death that attend severe respiratory disease," Dr. Dochez said. If an effective means of vaccinating against these two diseases could be developed, it would mean not only control of the colds and influenza, but also a possible lessening in the amount of all serious bacterial infections of the breathing organs.

Asserting that the goal of his studies on respiratory disease and a possible road to it have become clear, Dr. Dochez described the following achievements which helped to clear the way:

1. Studies showing that the common cold is caused by a filterable virus.
2. Growth in the test-tube of large amounts of the cold virus, which has been kept alive outside the animal body for 20 months.
3. Growth of the virus of influenza in the test-tube.
4. Transfer of the influenza virus from man to the ferret and from the ferret to the white mouse.
5. Discovery that the influenza virus from different parts of the world and at different periods of time is very similar in its activity.

ITEMS

A TINY wanderer of the sky, which might be considered either a comet or a minor planet, has been resighted by telescopes. It is the Delporte object first seen in 1932. It has the distinction of making the second closest approach to the earth of any such comet or planet. Its

magnitude is 13, the Harvard College Observatory reports, which means that it is possible to see it only with large telescopes. It is located somewhat west of the constellation of Leo. The Delporte object is also known by the name of Amor and its number among the minor planets is 1221.

SHOWER baths required before swimmers are allowed to enter pools are not enough to prevent the spread of the streptococcus infections of nose and throat, W. B. Ardrey, of the Michigan State College, reported to the Society of Bacteriologists, Pathologists and Allied Workers at a recent meeting in Detroit. Bathers are instructed to take their usual baths before entering the pools and then to stay at the shallow end of the pool and wade around. Few or no streptococci were found in the water until the bathers were told to swim and take exercises which placed their mouths and noses under water. Bacterial counts then made of the swimming pool water showed large increases in streptococci. This was explained on the basis that some water enters the nose and mouth and is immediately blown out again.

MANY cases of septic sore throat are directly attributable to drinking raw milk from infected cows, C. S. Bryan, of the Michigan State College, told the members of the Society of Bacteriologists, Pathologists and Allied Workers of Michigan, Indiana and Ohio. Investigation shows that as high as four fifths of herds tested which supplied one large city with milk were infected. In some herds only one cow had streptococci mastitis, but as high as 26 per cent. were involved. These infected cattle constitute a grave menace to public health because of the contagiousness of the infection. From the standpoint of the farmer they are also of little value, for such infected cattle produce 22 per cent. less milk and their butter fat production is reduced 24 per cent.

A PROTEIN substance found in milk and called lactalbumin helps in the prevention of rickets, Dr. James A. Tobey, director of the health service of the Borden Company, reported at a Farm and Home Week meeting held at Cornell University. The lactalbumin apparently does not have any rickets-preventing effect by itself, but when vitamin D is added to milk by irradiation with ultra-

violet light, the dispersed lactalbumin increases the effectiveness of the vitamin's rickets-preventing power. The discovery of the rôle of lactalbumin in augmenting the rickets-preventing potency of vitamin D in irradiated milk was made by Dr. George C. Supplee at the Borden research laboratories at Bainbridge, N. Y.

THE United States has more birth control clinics in proportion to its population than any other country, Dr. Eric M. Matsner, medical director of the American Birth Control League, has found in the course of a survey he has just completed. There are more than 225 such clinics under medical direction in the United States, an increase of 80 since last November. Birth control clinics are not only more numerous but more effective in this country. "Theoretically, Great Britain, the Scandinavian countries and the Soviet Union are in advance of America, since they regard birth control as a public-health measure," he stated. "Practically, they are not in advance, since the methods available to birth-control clinics there do not surpass and seldom equal in effectiveness those used in American clinics. In Russia the materials are of definitely inferior quality. However, the Soviet Commissariat of Health is seeking to improve birth control methods in order to decrease the number of abortions performed there."

PINE trees in the southern states produced in 1935 the most tremendous seed crop in years. Every five or ten years they bear a big crop of seed, but the past season's yield is huge even for a "big seed year." All four of the principal pine species—long-leaf, short-leaf, slash and loblolly—were thick with cones, and the winged seeds carpeted the ground. Forest interests took utmost advantage of the unusual harvest. CCC men gathered seed by the carload, for use in tree nurseries, without visibly diminishing the supplies left on the ground. Foresters, both federal and state, as well as progressive-minded lumber companies, urged timberland owners to refrain from their usual practise of burning off the forest undergrowth and grass, and to exert every effort to keep accidental fires out of the woods. If the forest lands of the South can be kept fire-free for the next few years, it is said that it will be worth hundreds of millions of dollars in timberland eventually restored to normal productivity.

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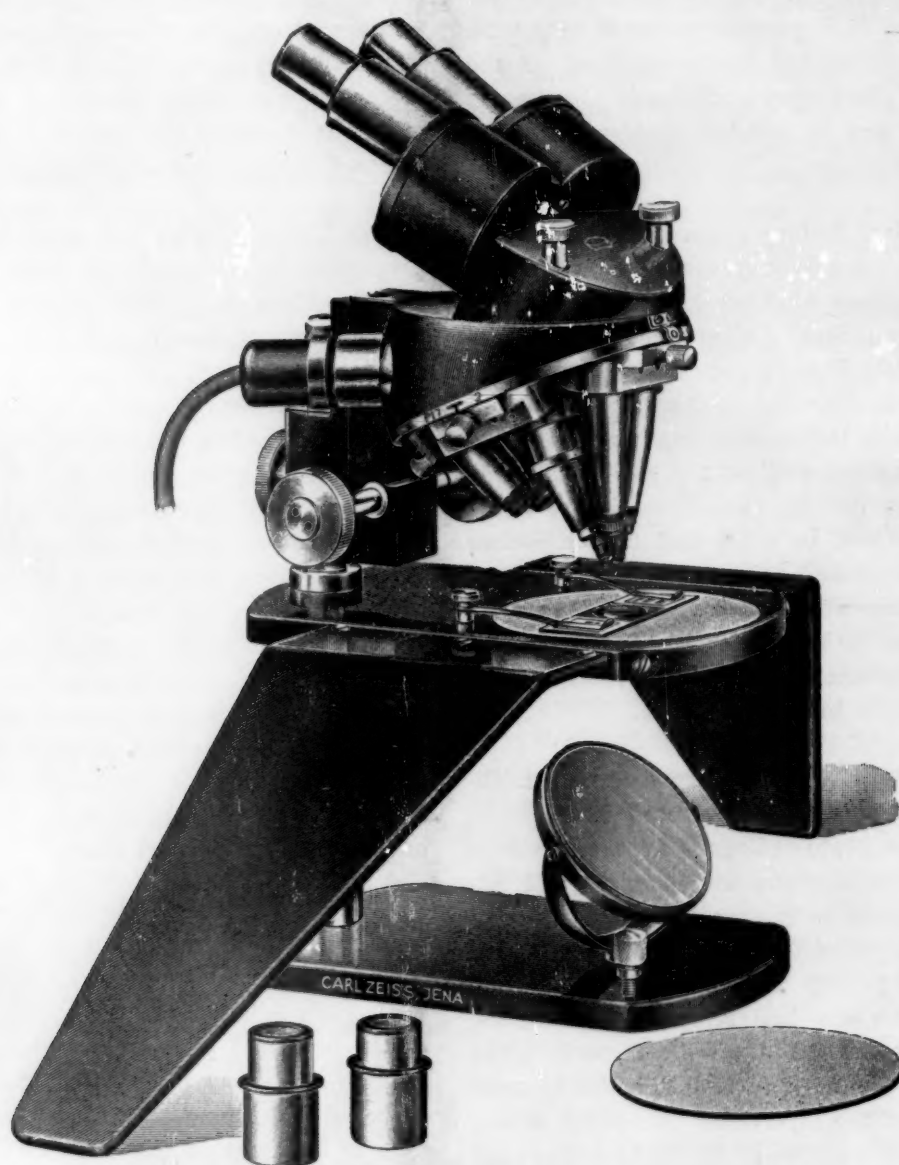
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SCIENCE NEWS

Science Service, Washington, D. C.

ATOMIC PROCESSES AND THE LAW OF THE CONSERVATION OF ENERGY

(Copyright, 1936, by Science Service)

IN the forthcoming issue of *Nature*, Professor P. A. M. Dirac, of the University of Cambridge, will ask, "Does the law of the conservation of energy hold in atomic processes?" And lest inventors think they now have good authoritative backing for their perpetual motion machines, let them note that Professor Dirac specifies atomic happenings and not the large-scale every-day world.

Professor Dirac believes that the conservation of energy does not hold in processes involving very high velocities comparable with the speed of light, nor need it hold in happenings involving radiation.

New experimental findings of Dr. Robert S. Shankland, of the University of Chicago, states Professor Dirac, do not agree with previous work and can only be interpreted if the conservation of energy law is given up. He says: "Physics is now faced with the prospect of making drastic changes in its fundamentals; changes involving the giving up of some of its principles which have been most strongly relied upon (the conservation of energy and momentum)."

The important consequence, states Professor Dirac, is that energy and momentum are conserved in atomic processes when the velocity is small compared to light's velocity, just as they are in the large scale world. The whole present quantum theory, therefore, can be retained if so applied. But the newer quantum electrodynamics used to explain radiative processes must go because of the high velocity of radiation quanta.

The new experimental work which inspires Professor Dirac's sweeping statement was performed by Dr. Robert S. Shankland, at the University of Chicago, at the direct suggestion of Professor Arthur H. Compton. It involves shooting gamma rays from radium at scattering material of aluminum, filter paper, beryllium, paraffin and air.

As the gamma rays hit the scattering material, electrons are shot out. The angle of distribution of these electrons and their energy constitute factors in what is known as the "Compton" effect, which won for Professor Compton the Nobel prize in physics in 1927.

From his original experiment Professor Compton went on to develop a theory, explaining the phenomenon, which satisfied the laws of the conservation of energy and momentum. He and other investigators performed, ten years ago, experiments which appeared to substantiate the theory.

But now, Dr. Shankland with newer and more refined equipment, developed in light of experimental advancement in the last ten years, has repeated the experiment and has found contradictory results. It is on this new result that Professor Dirac bases his belief that it is time to throw out the conservation of energy in atomic experiments.

THE "UNCERTAINTY PRINCIPLE"

(Copyright, 1936, by Science Service)

THE famous "uncertainty principle" of physics was extended to the sciences of biology and psychology by Professor Niels Bohr, Copenhagen Nobelist, in a lecture in London at the Warburg Institute.

According to the uncertainty principle as it applies in physics, it is impossible to tell simultaneously just where a subatomic particle is, and how fast it is going. If you know one of the two facts, the conditions of experiment prevent you from exactly knowing the other. This principle has powerfully shaken the hold of mechanistic determinism, or what has been styled "scientific predestination," on the thinking of physicists.

Professor Bohr called attention to an analogous situation in biology. It has been contended that if you knew all about every atom in a cell you would know all about the cell. But, Professor Bohr pointed out, that facts about the atoms that make up the cell can not be determined without tearing the cell to bits, thereby destroying the very make-up you wanted to find out about. You can not completely analyze life without destroying life.

An analogous "uncertainty principle" also obtains in psychology. Analysis in this science is infinitely more complex than it is in physics. The things in psychology which you may wish to examine are changed by the very act of examination; a picture of a mental situation becomes a different situation when attention is fixed on some part of it.

Racial differences also introduce an uncertainty element into psychology, Professor Bohr claimed. If a Dane or an Englishman gets sufficiently close to the mental culture of a Chinese or a Japanese, he ceases to be really a Dane or an Englishman, so the situation is changed and the attempted analysis is baffled.

Professor Bohr made a strong plea for mutual aid among scientists, regardless of nationality, in winning the common fruits of science, and especially in the conquering of racial prejudices.

THE SYMPATHETIC NERVOUS SYSTEM AND HEART ACTION

SCIENCE's first step toward an understanding of recently discovered nerve fibers for speeding up heart action, a discovery which may lead to their identification as hitherto unknown sympathetic nerves, was announced recently to the New York Academy of Sciences by Dr. Lucien A. Brouha, of the University of Liège, Belgium.

Discovered at the University of Ghent in 1934 by Jourdan and Nowak, the tiny fibers have remained pretty much of a mystery to science, the only definite fact known about them being their position alongside the vagi nerves which run from the brain to the heart and which serve to retard the cardiac beat.

Even now, Dr. Brouha explained, little is known of their function in the normal body—but in dogs whose

sympathetic nervous system has been removed, these new nerve fibers take its place. Indeed, so successfully do they substitute for the missing nerves that Dr. Brouha finds it absolutely impossible to distinguish a normal dog from one without its sympathetic system.

This finding is in direct contrast to results obtained with cats by Dr. Walter B. Cannon at the Harvard Medical School, for removal of the sympathetic system in these animals made them distinctly apathetic, incapable of exertion to any marked degree.

It was the ability of the new nerves to replace the sympathetic system in dogs that led Dr. Brouha to his conclusions concerning the possible function of the nerves as a substitute for the removed system. In the normal body, he believes, the nerves may aid heart regulation to a very small extent, although he said that in all probability they have additional functions as yet undiscovered by science.

In research leading to these results, Dr. Brouha conducted pioneer tread-mill tests on dogs both before and after removal of the sympathetic system. The experiments were performed in cooperation with Dr. David B. Dill, of the Harvard University Fatigue Laboratory, where Dr. Brouha is carrying on his investigations this year.

Outstanding among his results were that the general behavior of a dog whose sympathetic chains have been removed remains normal, although the heart beat of the animal at rest is slightly less than normal, and that emotional excitement produces the usual definite cardiac acceleration. If the dog takes light exercise, Dr. Brouha found, the cardiac rhythm remains below the normal rate, even during a long experiment in which the total amount of exercise done is considerable. When this exercise becomes more intense, however, the cardiac acceleration occurs in proportion to the intensity of the exercise—exactly as it does in the normal animal. Another important find was that the capacity to stand very intense exercise is not at all diminished three months after the removal operation, that time being necessary for the dog to recover from the effects of the operation.

Experimentally checking the possible influence of a rise in body temperature or muscular metabolism, Dr. Brouha found that they are definitely not responsible for the accelerated heart beat. Nor are adrenalin or sympathin, for with the removal of the sympathetic system, these hormones are not secreted into the blood stream.

This leaves only increased activity of the cardio-accelerator fibers of the vagi nerves to explain heart regulation. The activity of these fibers, Dr. Brouha says, is also accompanied by a reduction in activity of the retarding fibers of the vagi nerves whose functions along these lines are well known.

Testing the sugar and lactic acid content of the blood and the alkaline reserve of sympathectomized dogs, he found them all to vary within normal limits.

THE EFFECTS OF STIMULANTS

THE heart will not be harmed if alcohol or tobacco are used in moderation. The same is true for tea and coffee, according to a statement made by Dr. William

H. Robey, emeritus clinical professor of medicine, in a lecture given at the Harvard Medical School.

Even excessive use of these things may not add directly to the dangers and discomforts attending heart trouble, he added. Indirectly, however, such excess can be injurious through its deleterious effect on the general health and the greater work thrown on the heart and circulatory system in consequence.

"If alcohol and tobacco are used to excess, however," Dr. Robey said, "the digestion and often the general health of the individual suffer and those defects throw more work upon the heart and blood vessels. Sufferers from angina pectoris, for example, may have more frequent attacks if they use tobacco. Stomachs which are injured by the undue use of alcohol upset the general health which also in turn throws a strain upon the heart."

Turning to the prevalence of heart disease, Dr. Robey stated that it is the most frequent cause of death in the United States. The increase in heart disease, however, he termed perfectly natural and said that the pre-eminence of cardiac disease in later life will increase rather than decrease as time progresses. The reasons for this increase, he said, are the following:

"First, children's diseases are better controlled and therefore the mortality during the early years is much less. Hence more individuals by escaping disease and death in childhood advance to middle life when the wear and tear upon the heart and circulation become manifest. If we are successful with our plans for a greater control of heart disease it is not unreasonable to hope that the average duration of life can be considerably raised.

"Secondly, a better understanding of rheumatic fever and allied diseases has lessened the harm done by these conditions and has quickened the attention of physicians to their cardiac dangers.

"Finally, the control of syphilis and gonorrhea has also reduced the heart disease dependent upon those infections. Syphilis insidiously affects the heart and circulation and incapacitates the individual about twenty years after its inception at a time when the activities of the patient should be at their height. Gonorrhea rarely affects the heart but when it does the involvement occurs during the acute stage of the infection and is usually fatal. Boards of health have for several years maintained free laboratory facilities for the early diagnosis of these diseases and physicians are constantly urged to make use of them in order to institute prompt treatment."

Stressing the necessity of early diagnosis and proper care as a preventive of serious heart trouble, Dr. Robey said that if we have certain physical limitations, it is by far the best policy to learn what they are and to live within them.

ELECTRICAL PROSPECTING FOR COAL DEPOSITS

THE same technique of using electrical prospecting methods—often likened to electrical divining rods—which has worked so successfully in discovering oil, gold

and other minerals, is now being used to find deposits of coal in Pennsylvania.

It was stated at the meeting of the American Institute of Mining and Metallurgical Engineers in New York City that the new electrical methods, based on how well a seam of coal conducts electricity, were successful in the Mahanoy fields which have been worked for 70 years.

Most of the coal seams, Dr. Maurice Ewing, A. P. Crary, J. W. Peoples and J. A. Peoples, Jr., describe in their report, were worked near the surface in the past but since the workings were never completely or accurately mapped complete extraction of the coal from older pits was not obtained. In consequence, they point out, virgin bodies of coal, not known, are yet to be found.

The electrical prospecting consists of passing a known electric current between metal stakes driven into the ground at considerable distance apart. How much current will flow between the stakes depends on how well the underlying minerals conduct the current.

Anthracite coal, for example, passed electric current from 10,000 to 2,000,000 times easier than shales and sandstones. In other words, the resistance of the coal to the passage of the electric current is much less by factors of from 10,000 to 2,000,000 times.

"The presence of outcrops of an anthracite seam is indicated at points where electrical resistivity rests show relatively low readings," is the way the technical report reads. Test drilling and strip mining confirmed the findings.

ITEMS

BREAKING all cold-weather records for more than a century, is the characterization given the present winter by Charles D. Reed, of the U. S. Weather Bureau station at Des Moines. Not since white men began to watch thermometers in the heart of the Corn Belt, and jot down the minus quantities they read, has there been a cold spell so severe or so prolonged. Official weather records have been kept in the state only since the winter of 1878-79, but before that, running back into early settlement days 117 years ago, there are recorded temperatures from various parts of the state, and these can be pieced together and compared with present-winter records from the same localities. Mr. Reed has done this, and finds the story the same everywhere: there has never been a winter like this one, since white men kept a history of the weather.

SPEAKING before the meeting of the American Physical Society, meeting in New York City, Drs. M. C. Henderson and M. G. White, of Princeton, described details of the newest atom gun, which will weigh 42 tons. The equipment of the magnetic accelerator type known as the cyclotron because atomic particles are speeded up by being whirled around the apparatus in an ever widening spiral, will generate high speed particles having energies of 11,000,000 volts energy. Such particles are made to strike chemical elements and the collision yields all manner of chemical changes which rival the dreams of the ancient alchemists. A small model at one tenth scale has already been built and tested. The giant apparatus based on such tests should yield a magnetic field strength of from 17,000 to 19,000 gauss. The earth's, for comparison, is only a fraction of one gauss.

BECAUSE there is a doubt about the theory that short radio waves reach the earth from stars in the Milky Way, investigators at the Institute of Technology have erected delicate apparatus in the center of a 10-acre farm near Pasadena to study the origin of the radiation. The research, being conducted by Dr. G. W. Potapenko and D. F. Folland, follows studies made by Dr. Karl G. Jansky, of the Bell Telephone Laboratories on static. No signals as yet have been received. In his experiments, conducted in New Jersey, Dr. Jansky observed three kinds of static, the third of which he speculated originated in the stars in the Milky Way, or reached the earth as the result of secondary radiation. Mr. Folland expressed the opinion that it is probable the short waves, found by Dr. Jansky to be 14.6-meters in length, do not originate in the stars. Dr. Jansky reported that he heard this mysterious hissing when the antenna of his apparatus was directed at the center of the galaxy.

FIELD tests of television will begin in the New York area within eight weeks, states the annual report to the stockholders of the Radio Corporation of America. The field test, emphasizes David Sarnoff, president of RCA, does not mean that regular television service is at hand. Transmission from studios at the top of the Empire State Building will be pioneering tests to estimate and define the possibilities of the system under actual working conditions rather than the refined and controlled laboratory conditions of the past. Problems to be solved during the tests will include: determination of how far transmission can be achieved; with what consistency and regularity can pictures by television be transmitted in the present stage of development, and the possibilities of the television camera for indoor and outdoor pick-up.

WOLF fighters, skilled in warfare against these voracious pack-hunting beasts, are asked for in an emergency wire from Governor John W. Troy, of Alaska, recently received at the Department of the Interior. Because of the severity of the winter, vicious gangs of wolves have been raiding the reindeer herds owned by natives of northern Alaska, threatening to undo the work of years in raising their standard of living and teaching them the ways of civilization. Native hunters have proved unable to cope with the animals, but it is believed that about four hunter leaders, each with a few assistants, could in a swift campaign break up the marauding bands.

PIGS will be better protected against their worst disease, hog cholera, by a new vaccine now under investigation by research workers of the U. S. Department of Agriculture. Crystal violet, a chemical not hitherto used in preparing such vaccines, appears to be the key to its greater effectiveness. In preparing hog cholera vaccines in the past, three other chemicals have been used: glycerin, formalin and phenol or carbolic acid. Vaccines generally are made by adding to blood serum containing the virus of the disease some chemical that will weaken its power to harm, yet not destroy its ability to provoke the formation of disease-preventing "antibodies" in the blood of the animal or person to be protected. Crystal violet appears to be a much more advantageous material to use for this purpose.

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SCIENCE NEWS

Science Service, Washington, D. C.

A MINOR PLANET AND CLOSE TO THE EARTH

A GREAT rock hurtling through space is having its photograph taken by astronomers eager to chart its heavenly path before it disappears from view.

This new minor planet is the smallest object in astronomy's annals, except the meteorites which smash into the earth. It came closer to the earth than any other thing in the heavens, except possibly one or two comets.

It is known as the Delporte object, after the Belgian astronomer Professor E. Delporte who discovered it on February 12. Not until several more observations were made could its path in the heavens be computed and its unusual diminutiveness and proximity discovered.

Here are the Harvard Observatory figures showing the new planet's claims to fame: Size—One third mile or only one twenty-five thousandth of the earth's size. Weight—Five hundred million tons, about the same as a small mountain. Distance away—When first observed was within two or three million miles of the earth.

Cable advices to Science Service from the International Astronomical Bureau at Copenhagen described it definitely as "planet," that is, a minor planet or asteroid, with an elliptical path around the sun.

Orbit computations made at Harvard College Observatory, University of California and University of Michigan show that the tiny planetoid is moving swiftly away from the earth. Drs. Fred L. Whipple and L. E. Cunningham located and photographed the Delporte object with the new and powerful instruments at Harvard's Oak Ridge station in the town of Harvard, Mass.

Professor Delporte has been an active discoverer of small planets and comets. One such object that he discovered in 1932, also called the Delporte object, came very close to the earth, but the present object is not the same.

Through a study of the tiny object astronomers believe they may be able to discover many hitherto unknown characteristics of similar small particles. They also hope to determine its orbit so as to make possible a prediction as to if, and when, it may return.

Because the object is so small, it is expected to be greatly affected by the gravitational forces of the planets Venus and Mercury, which it passes very closely, thus permitting the most accurate measurements ever made of the masses of these planets.

Preliminary calculations at Harvard indicate that the orbit is on approximately the same plane as that of the earth. Its closest approach to the sun is about half the distance from the earth to the sun, while its greatest distance from the sun is equal to about one and one half the earth-to-sun distance.

The estimated length of time required for the completion of the orbit is roughly sixteen months, the shortest period for any heavenly body, with the exception of the earth, Venus and Mercury.

THE BIOLOGICAL ACTION OF NEUTRON RAYS

(Copyright, 1936, by Science Service)

DEADLY danger for young research workers in physics lies in wait in their own laboratories, if they work with powerful new atom-smashing machines using streams or rays of neutrons.

Neutrons are the uncharged particles of matter which can be knocked out of the cores of atoms. They are widely used as atomic "bullets" to pierce the inner nuclei of other atoms and are capable of effecting transmutation of the elements and synthetic radioactivity.

Warning of the potential danger in using such neutron rays is drawn from the results of two investigations on their biological effects, which have just been published in the *Proceedings* of the National Academy of Sciences. The neutron rays appear, in summary, to be ten times more potent than x-rays in what they can do to the body.

In the first research carrying its warning to scientific workers neutron rays were used on white rats. It was presented by two brothers, Dr. John H. Lawrence, of the Yale University School of Medicine, and Professor Ernest O. Lawrence, of the University of California, who built the large cyclotron apparatus with which the neutron rays can be produced. The second, in which neutrons were shot at just-sprouting grains of wheat, was the work of Dr. Raymond E. Zirkle, of the University of Pennsylvania, and Dr. Paul C. Aebersold, of the University of California Medical School.

Exposure to neutron rays was deadly to white rats. They grew sick, miserable-looking, humped-up and died. The rays were apparently bad for them "all over," but as a quantitative measure of their effect, the decrease in the number of the necessary white blood corpuscles in their blood was counted. It was found that destruction of white-blood cells was as great from a given dose of neutron rays as it was from a ten times more intense dose of x-rays, heretofore counted among the really dangerous scientific tools. The effects of neutron rays on growing plant tissue were found by Drs. Zirkle and Aebersold to follow about the same ratio: neutron rays are ten times as dangerous as x-rays.

Commenting on their results, the Doctors Lawrence stated: "This should constitute a warning inasmuch as many laboratories will soon be using neutron generators of such power that individuals in the vicinity of the apparatus will be exposed to many times the allowable dosage in the course of a few minutes unless adequate protective screening is provided." They set the "allowable dosage" at just one tenth the intensity of x-ray exposure that workers can stand without permanent damage to their health.

If the present warning is heeded by investigators in the universities now setting up apparatus for producing neutrons, the world may be spared the tragedies that followed

Published February 1936

***A textbook for courses
in the psychology of motivation***

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animal behavior, educational, social and
applied psychology, and specialized courses**

In the last few years the experimental study of motivation has come rapidly to the forefront of psychological research. Its fundamental importance to the science is more and more plainly recognized. Because of its comparatively recent development, however, there has been up to the present time no textbook suitable for use in a course covering the subject. To supply that lack, Professor Young has prepared this new book, based on his investigations and readings in the literature for many years.

For three semesters the material in the book has been thoroughly tested by actual use, in lithoprinted form, at the University of Illinois, and for one semester at Stanford University. Its teachability is thus assured. Furthermore, the book includes reports of the most recent experiments in the field, and is therefore entirely up to date. Parts of it contain reports of the author's own researches, some of which have never before been published. Throughout the book the attempt is made to preserve an impartial viewpoint in regard to the several schools of psychological thought existing today in the study of behavior. This enables the student to acquire a scientifically unprejudiced picture of the various aspects of motivation.

The approach is factual: Speculation and theory have been strictly subordinated to the presentation of laboratory findings based for the most part upon experiments which have been carried out during the past ten or fifteen years. An excellent bibliography is appended at the end of each chapter, listing the more pertinent guides to the available sources. An important feature is the section at the close of the book giving questions and exercises designed to aid the beginning student in study and review of the materials in the different chapters.

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MOTIVATION OF BEHAVIOR

The Fundamental Determinants of Human and Animal Activity

By PAUL THOMAS YOUNG

Professor of Psychology

University of Illinois

JOHN WILEY & SONS, INC., 440 FOURTH AVE., NEW YORK

the discovery of x-rays in the late 1890's, and of radium early in the present century.

Not knowing the deadliness of the then new rays to living cells, many of the early workers were severely burned, and even maimed for life, through reckless exposure. Even yet, there are veteran x-ray technicians in scientific laboratories and medical clinics whose hands are seriously damaged—unwitting victims of the two-edged tool they used in their younger days.

THE WOOD OF OLD VIOLINS

THE secret of how the old master violin makers determined the right kind and graininess of wood to use in their beautifully-toned fabrications now is believed found. They may have used a hot branding needle on wood which had been given a slight wax coating.

If the wood was homogeneous the melting wax formed nearly a circle around the hot needle. If the wood was inhomogeneous and possessed grain the branding test showed a long, stretched, narrow ellipse.

Such at least is the simple test discovered by Professor K. Lark-Horovitz, of Purdue University, who, for years, has been studying the composition of the wood in old violins by x-rays. From the studies, some of the mystery behind the beautiful tone of an Amati or a Stradivarius violin has been learned. Professor Lark-Horovitz has found, for example, that the best instruments have a top of spruce or pine and a back of maple. The top, x-ray investigations show, must possess a distinct fiber structure. The back, of maple, is almost without structure if the instrument is to have a good tone.

What Professor Lark-Horovitz never could figure out was how the old sixteenth-century violin makers, 300 years before the discovery of x-rays, were able to tell what the wood structure might be. The only clue was the markings of branding needles which can be seen on the old masterpieces' art. From this clue Professor Lark-Horovitz finally found the simple hot branding needle test which, in its way, might tell roughly the same facts in the hands of a master as the more modern x-rays. In a lecture given before the Franklin Institute, Philadelphia, he stated that there is nothing known "about the actual use of this method, but it might be an explanation of the many traces produced by branding needles which we see on old instruments."

PREVALENCE OF MENINGITIS

MARCH and meningitis generally go together, as many communities in the United States are now realizing. Outbreaks of this serious disease, which is an inflammation of the membranes covering the brain and spinal cord, are current in Tennessee, Texas, Virginia and Kentucky. Increased number of cases all over the country have been reported to the U. S. Public Health Service.

Health officers were rather expecting this year's increase in meningitis. The disease seems to follow a cycle, the number of cases dropping to a low point and then after an indefinite number of years, rising to a high point. There was some increase last year, which suggested that the disease was on the up-swing of the cycle, and that there would be many cases this year.

In the temperate zone, which takes in the United States, meningitis is most prevalent in winter and spring, reaching a high point in March and April. It may occur at any season but there is generally more of it during winter and spring. The disease is caused by a "germ." Epidemic meningitis, the kind now growing to epidemic proportions, is caused by the "germ" known as the meningococcus. The "germs" of tuberculosis, pneumonia and the streptococcus may also cause an inflammation of the membranes that cover the brain. The technical name for these membranes is meninges, so an inflammation of them, no matter what the cause, is called meningitis, just as inflammation of the tonsils is tonsillitis. Scientists say "epidemic meningitis" or "meningococcic meningitis" when they mean the kind caused by the meningococcus.

Epidemic meningitis starts suddenly with headache and fever, a severe chill, explosive vomiting and stiffening of the neck. A physician should be called at once as early treatment is important. Diagnosis of the disease is made by examining the fluid within the spinal cord. Fairly good results have been obtained by treating the disease with a serum made from the blood of horses that have been inoculated with the meningococcus.

THE SPEEDING UP OF ELECTRIC TRAINS

FASTER and smoother acceleration on electric trains operated by the London Transport is made possible by the new method of controlling electric current known as the "metadyne." The system is the invention of the Italian engineer, G. M. Pestarini, and has been developed by the Metropolitan-Vickers Electrical Company.

With the new system a speed of 17 miles an hour can be obtained ten seconds after a train starts from rest. The present methods permit only 10 to 13 miles an hour speed after the same ten-second interval. New stock just ordered will have an acceleration of 2 miles per hour each second, or attain a 20-mile-an-hour speed in ten seconds. Because of the nature of the system such high accelerations can be attained without being noticed by the passengers.

With the type of equipment previously used by the London Transport, in which the current is fed through the resistance box controlled by the motorman, the acceleration is not continuous since the current to the driving motors is increased in steps. By contrast, the metadyne system is one of continuous, controlled acceleration without jerks. Owing to its smoothness in picking up speed it is possible to achieve greater acceleration without slipping the wheels or making passengers uncomfortable.

The standard system of control used on the board's railways to regulate the flow of current to the motor incorporates a series of resistances in the circuit. In starting a train the power must be applied to the motor by cutting out the resistances, so that the voltage reaching the motor is increased progressively. The current consumed, however, remains more or less constant, that portion not used by the motor being dissipated in the form of heat.

In the metadyne system the current passes to the negative rail through the metadyne, a type of rotary trans-

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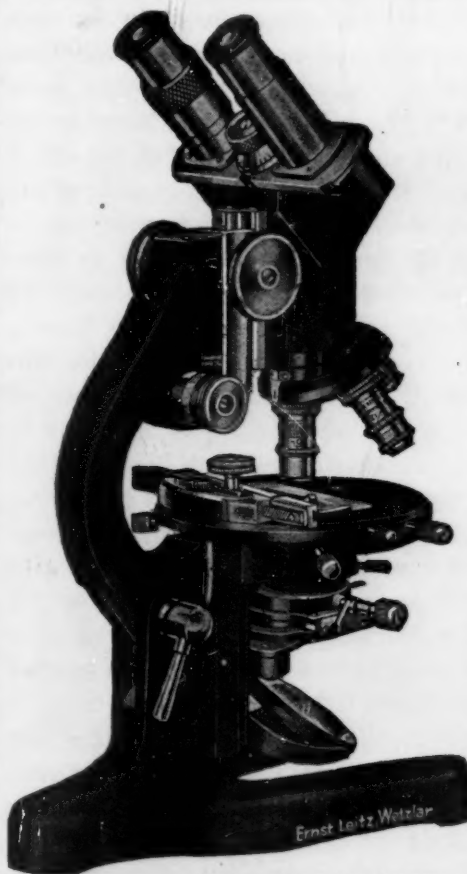
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AMERICAN GREAT LAKES HARBORS

CANADA and the United States may have reciprocal trade agreements, but the United States is benefiting at the expense of Canada in another matter over which man-made laws have no control. Harbors on the American side of the Great Lakes are getting deeper and those in Canada are becoming shallower.

The reason, as explained by Captain H. V. Canan, U. S. Corps of Engineers, is that the region about the Great Lakes is tilting about a "hinge line" which roughly is in the direction of 20 degrees west of north.

This tilt, says Captain Canan in the new issue of *The Military Engineer* just published, is generally improving conditions in harbors on the American side of the Great Lakes. He adds: "This action is material rather than merely of scientific interest and amounts to as much as 0.3 feet in some harbors. Considering vast harbor areas which are maintained to prescribed depths, a large saving in maintenance dredging costs will result when the effect of tilt on American harbors is given proper consideration. This uplift also affects the flow and the flow equations in the connecting rivers of the Great Lakes, and in computing flows for these rivers over extended periods its effects are clearly recognizable. Tilt has also been a factor in decreasing the available depths over the sills of the locks at Sault Ste. Marie, Michigan. Much of the evidence presented of decreasing lake levels is in reality the effect of tilt. Reports indicate that in about 1860, North Bay, Wisconsin, was an important harbor for schooner navigation, as many as 35 boats tying up there at one time. Adjoining a rock ledge, old ring bolts used for mooring these boats can still be found. Correcting the present charts for the stage of 1860, only about 3 feet of water would have been available. This loss of depth can only be attributed to earth tilt."

Describing what effect the observed land tilting will have on the future of the Great Lakes, Captain Canan says: "There has been much sensational speculation as to the geological future of the Great Lakes. Rather than the danger of the lakes draining down the St. Lawrence through failure of the outlet plugs, the more apparent danger, if tilt persists, is the draining of the Great Lakes above Niagara down the Mississippi system. While speculation of this sort may be mentally stimulating, any danger is so remote, and the engineering steps

necessary for prevention are so relatively simple, that there is little danger of losing the vast investment by the United States and Canada on the Great Lakes."

The generally accepted explanation for the land tilt on a line passing through the Great Lakes is that the land to the north, in Canada, is still rising from the enormous squeezing which it received during the last Ice Age.

ITEMS

THREE iron meteorites, and a large fragment of a fourth, have been brought back from Chile by Mark C. Bandy, who has just returned from a collecting expedition for the Smithsonian Institution and Harvard University in the northern part of that country. The largest of the meteorites weighs 65 pounds. In addition to the "irons that fell from the sky," Mr. Bandy has brought with him a considerable collection of mineral specimens of terrestrial origin, some of which are of previously unknown types.

EXTENSIVE experimental planting of chestnut trees from Asia are to be made in the George Washington National Forest in Virginia's Blue Ridge during the present month. The test is to determine whether the trees can take the place of the native chestnuts, practically wiped out during the past three decades by the fungus-caused chestnut blight. This fungus came to America from the Orient, where chestnut trees are resistant to it. Many varieties of Oriental chestnuts have been brought to this country by plant explorers of the Department of Agriculture, and their seedlings are now ready for planting. The destruction of the chestnuts was a major blow to American forest industries, for the chestnut is a tree of many uses. It yields rough timber, wood for furniture making, bark for tanning, nuts for human food, and is also one of the most valuable trees for the support of wildlife in the forest.

ONLY fifty or sixty of South Africa's rarest animal, the mountain zebra, are left alive, and no funds are available for the further protection of the two small herds, according to an announcement made by Dr. E. L. Gill, director of the Cape Town Natural History Museum. A strict law for the protection of this animal was passed some time ago, but has never been strictly enforced, so that hunters have done their worst. There were 2,000 animals a few years ago, only fifty or sixty now, and this small fragment is apparently doomed.

FUR seals off the Northwest Coast are apparently not enemies of salmon—their underwater playfellows—if an examination of stomach contents made by Leonard P. Schultz and A. Morris Rafn, of the University of Washington, can be taken as a criterion. The stomachs of 41 fur seals, killed for food by Indian hunters, were preserved and their contents analyzed by the two research men. By far the greater bulk of the food taken by the seals consisted of squid and herring. "No bones or flesh of salmon were found," they report. "Partly digested, pink-colored squid meat might have been mistaken for that of salmon if the structure of the flesh had not been carefully studied." A full report of the study is made in the current issue of the *Journal of Mammalogy*.

SCHOOL AND SOCIETY

EDITED BY J. McKEEN CATTELL

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DR. SILBERSTEIN'S CRITICISM OF THE
GENERAL THEORY OF RELATIVITYBy MORRIS OSTROFSKY,
*Institute for Advanced Study,
Princeton, N. J.*

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PROBABLY no field in modern science is attacked more often than the general theory of relativity. In a recent paper to *The Physical Review*, Dr. Ludwik Silberstein, of Toronto, Canada, using a method developed by the Italian mathematician Tullio Levi-Civita, solved the, so-called, gravitational equation of the general theory of relativity for empty space for the special case of symmetry. Dr. Silberstein claimed that the solution which he obtained is "regular," that is, all right, throughout all space except for two special fixed points called singular points. An idea of a singular point may be obtained by analogy with a line. In this case a singular point will be a break or a sharp corner in the line.

In the interpretation of his solution Dr. Silberstein took the two singular points to represent material particles and reached the conclusion that the general theory of relativity predicts no mutual acceleration of the two particles. This, of course, is known to be wrong as two material particles in free space will attract one another and move accordingly. It seemed therefore that the theory of relativity is incorrect.

In publishing their answer to this charge, Professor Einstein and his assistant, Dr. Nathan Rosen, say that, in the first place, it is not correct to represent a material particle by a singular point in the field theory of general relativity as did Dr. Silberstein. This makes the latter's premise wrong. In the second place, even granting this premise, Professor Einstein and Dr. Rosen show that in the solution of the gravitation equation there appear, in addition to the two singular points, other singularities. Therefore, the conclusions drawn by Dr. Silberstein can not, in any case, be made. These facts were pointed out by Professor Einstein to Dr. Silberstein even before the latter published his results.

So to date there has not been brought any valid argument, either theoretical or experimental, against the general theory of relativity.

THE CYCLOTRON AT PRINCETON

THE installation of a cyclotron, calculated to bombard atoms with particles moving almost half again as fast as those produced by existing machines, began this week with the arrival of forty-one tons of steel at the Palmer Physical Laboratory of Princeton University.

The bombarding particles will consist of hydrogen ions, and deuterons or charged particles of heavy hydrogen. Results obtained from paper calculations and from a small working model show that they will travel with a velocity of 19,000 miles a second. Their maximum energy is expected to be twice that of particles from present machines. A large magnet, built especially for use in the cyclotron,

makes possible the attainment of this high speed. It is hoped that the machine will shed further light on the old problem of disintegrating the atom.

A breastwork of earth will protect the operators of the machine. Water tanks may also be constructed as an additional safeguard, as cyclotron experimenters are exposed to hazards somewhat similar to those the early x-ray pioneers faced.

When the cyclotron is in use the two vacuum tubes, which produce high-frequency oscillations at 20 meters, will require 50 to 60 kilowatts, as much power as is used by a large metropolitan broadcasting station. The oscillations take place inside the magnet, which prevents the waves from interfering with ordinary radio reception in the community.

Drs. Malcolm C. Henderson, instructor in physics at Princeton University, and Milton C. White, a National Research Council fellow at Princeton, are the designers of the machine. Both men participated in the pioneer cyclotron experiments at the University of California.

Explaining how the Princeton installation is expected to be the most powerful in existence, Dr. White said: "The tip of the pole pieces of the Princeton installation will be 35 inches in diameter, while the most powerful similar apparatus, of Dr. E. O. Lawrence at the University of California, has 27-inch diameter pole tips. Since the energy of the accelerated particles produced increases as the square of the diameter, we get 35 squared divided by 27 squared or approximately 1.7. However, the more powerful oscillators at Princeton will perhaps permit operation at higher magnetic fields than is now possible at Berkeley so we expect, theoretically, to attain twice the present obtainable energy."

Other devices more powerful than the Princeton machine are now contemplated, but none is likely to be in operation before the apparatus is completed in September.

FLOW OF BLOOD THROUGH THE
CAPILLARIES

A METHOD of gaining new knowledge on obscure diseases of blood vessels and on the watery swellings known as edema was described by Dr. Eugene M. Landis, of the University of Pennsylvania Medical School, at the meeting of the American College of Physicians in Detroit.

For the development of this method, Dr. Landis was awarded the John Phillips memorial medal of the college. The method is designed to give information about the state of minute artery endings called capillaries. These are found at the tips of the fingers and toes, in the nail beds, and just under other outer surfaces of the body. In certain conditions like Raynaud's disease, in which the fingers and toes are always cold and an unhealthy white color, physicians know a disturbance of the blood flow through the capillaries is to blame. Just what the disturbance is and what to do for it are still unsettled questions which are engaging more and more the attention of medical research workers.

The method Dr. Landis devised for investigating the

VITAMIN A

On January 30th, 1932, Mead Johnson & Company announced an award of \$15,000 "to be given to the investigator or group of investigators producing the most conclusive research on the vitamin A requirements of human beings." (J.A.M.A., January 30, 1932, pages 14-15.)

This award was extended on February 11th, 1933 (J.A.M.A., pages 12-13) to include an additional award of \$5,000 for a laboratory investigation "which may later serve for, or point the way toward an evaluation of the vitamin A requirements of human beings."

In accordance with the terms announced, the Judges decided (April 10, 1935) that the Clinical Award should be postponed until December 31st, 1936, and that the Laboratory Award should be divided between Dr. S. B. Wolbach, Harvard University, for his basic work on the pathology of avitaminosis A, the regeneration of epithelial tissue impaired by vitamin A deficiency, and the relationship of vitamin A to the integrity of the teeth; and Dr. Karl E. Mason, Vanderbilt University, for distinguishing exactly between the pathology of avitaminosis A and avitaminosis E, and for his contribution to the quantitative relationship of vitamin A deficiency to the keratinization of germinal epithelia.

The Judges for this award were announced February 11, 1933: Isaac A. Abt, Northwestern University; K. D. Blackfan, Harvard University; Alan Brown, University of Toronto; Horton R. Casparis, Vanderbilt University; H. F. Helmholz, Mayo Clinic; Alfred F. Hess, Columbia University; E. V. McCollum, Johns Hopkins University; L. B. Mendel, Yale University; L. T. Royster, University of Virginia; and Robert A. Strong, Tulane University.

PRESENT STATUS

Many papers on vitamin A have appeared since December 31st, 1934. Most of these have been in the field of laboratory experimentation, but, in addition, numerous publications involving clinical studies have appeared. From time to time, available abstracts of such work are sent, by the Secretary, to the Judges.

It is to be noted that the main award will be made on the basis of papers published, or accepted for publication, by December 31st, 1936.

It is the earnest hope of the sponsors of this award that the large amount of experimental work which has been done since January, 1932, will permit a true evaluation of the vitamin A requirements of human beings.

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state of these capillaries is to insert a very tiny glass tube called a pipette into a single capillary in the bed of a man's nail or in tissues of other animals. The capillary blood vessels and the glass tube are both so small that the work must be done under a microscope.

By this method the passage of fluid through the walls of normal capillaries into the surrounding tissues was measured. With this as a standard, Dr. Landis measured the passage of fluid when the capillary walls had been damaged by chemicals or by mechanical injury. He found that the fluid passed through the damaged capillary walls from five to seven times more rapidly than normal. This finding shed light on the condition known as edema in which apparently too much fluid passes through the capillary walls.

GREEN LIGHT AND PRIMITIVE GREEN PLANTS

GREEN light is injurious for green plants of the primitive group known as the algae. They seem to find it definitely poisonous, faring worse in its presence than they do in absolute darkness. This hitherto unknown fact about the relation of light and plant life was discovered by Dr. Florence E. Meier, in the laboratories of the Smithsonian Institution.

Dr. Meier has been working for several years, studying the various effects of radiation on plants. For simplicity's sake, she uses the algae, most familiar in every-day life as the green scum that forms on stagnant water, and the green mats that spread themselves over wet soil.

In her present experiments, she first kept a quantity of green algae in complete darkness, though supplied with mineral nutrients in solution. They of course failed to increase in number, and after a time degenerated and slowly died. She exposed a similar quantity to full sunlight. As expected, they increased and multiplied—fourfold in two weeks. Then she tried the effects of various parts of white light. A narrow band of blue light was distinctly encouraging; the algae increased threefold in the same period. Red and yellow light gave results not quite so good—only twofold increase in two weeks.

But green light was worse than no light at all. The cells not only refused to increase in number, but actually decreased. There was no cell division, and many of the cells died. The green light apparently is actually poisonous to these organisms.

Infra-red light—the invisible rays at the lower end of the solar spectrum—seems to have no more significance for plants than it has for the human eye. Under it, the algal cells acted as they had in complete darkness.

PURE PHOSPHORUS

PHOSPHORUS in the 100 per cent. pure elemental form is one of the possibilities of the TVA-powered fertilizer plants. This possibility has developed out of the efforts of the TVA to produce more and more concentrated forms of superphosphate fertilizer.

The story builds up by degrees, like the percentage of phosphorus in the various phosphate products under experiment in the Valley. The raw phosphate rock, as dug in the Tennessee Valley and elsewhere, contains a fair

amount of phosphorus. Powdered and put on the land "as is," its plant food would become available so slowly that its use would scarcely be practicable. It is also entirely too bulky in relation to the amount of available plant food it contains to pay for long transportation.

The powdered rock is commonly converted into superphosphate by adding sulphuric acid. This common superphosphate averages from 7 to 8.7 per cent. of actual phosphorus content.

There has also been on the market a "triple-superphosphate" fertilizer of up to 18 or 20 per cent. actual phosphorus concentration which is made by adding phosphoric acid of 45 to 55 per cent. strength to the powdered raw material. The product is moist and gummy and has to be aged and dried before it can be handled. It has never been particularly popular with farmers because of its cost and its poor physical condition. They do not realize that, although this material is higher in price per ton than regular superphosphate, it is cheaper per unit of plant food and therefore more economical.

The TVA phosphate plant has been experimenting with a triple-superphosphate made by an improved method. This has proved successful in limited tests and now is being tried out under actual farm conditions. A new phosphatic compound stepping up the content of elemental phosphorus to about 28 per cent. is now being tested as a fertilizer at experiment stations.

TVA's triple-superphosphate has been made possible by development of methods of mixing high strength phosphoric acid with ground phosphate rock to yield a dry, easily handled product.

What comes out of the rock in the electric furnace is the elemental phosphorus itself in gaseous form at high temperature. At ordinary temperatures phosphorus is a waxy stuff that burns spontaneously if left exposed to air.

A RADIO TUBE WITHOUT A FILAMENT

A NEW type radio tube without a filament and having potentialities in the development of television and the design of light-weight radio transmitters for aircraft was shown for the first time publicly before the meeting of the Institute of Radio Engineers on March 4 by Philo T. Farnsworth, Philadelphia radio and television engineer.

The new radio tube is of the cold-cathode type and is known as the multipactor. The operation of the tube, said Mr. Farnsworth, is based upon the harnessing of so-called secondary electrons which are emitted by certain metals when bombarded by other electrons inside the tube.

High amplification is achieved because a single free electron inside the tube liberates a million electrons from the cold cathode surfaces when it strikes. And it does this in a millionth of a second. Inside the tube the million freed electrons in turn strike the metal surfaces and liberate a million times a million other electrons from the cathode. Enormous currents are thus quickly built up inside the tube which, if left uncontrolled, would release enough electrons to be equivalent to all the electric current consumed by all the electrical apparatus in the world.

While this great current gain is theoretically possible it is, of course, never achieved in practice, for the tube would quickly have its parts fused together. The free

electrons of the tube which start the bombardment and the subsequent amplification gains in current, said Mr. Farnsworth, are normally present in the tube because of the action of natural radioactivity or cosmic rays, or because the electrons are released from metals by the action of light (photo-electric effect). The new tube should be of great advantage in television transmission because of its quicker response and amplification. He also predicted that it would have considerable influence in the design of future radio transmitters, mentioning, especially, transmitting sets for aircraft where the question of weight and simplicity is of the highest importance.

The revolutionary part of this tube is that it operates without a hot filament, whereas in the standard type of radio tubes amplification is secured by the boiling off of electrons from the hot cathodes. This new tube operates by recruiting electrons from a cold surface. Because there is no heating of elements required, there is little loss of efficiency. Radio transmitters thus may be built with fewer tubes, operating at a much higher efficiency.

ITEMS

SCARLET fever cases are more numerous throughout the country than at any time since the U. S. Public Health Service began collecting reports of cases from state health officers in 1912. For the week ending February 29, the latest for which figures are available, there were 8,777 cases of scarlet fever reported to the Federal Health Service. This is nearly a thousand more cases than were reported for the corresponding week last year. Influenza and meningitis are also high, although they have not really reached epidemic proportions. There were 307 cases of meningitis reported for the week of February 29. Census bureau figures from 86 large cities of the country show a high death rate from all causes. The general death rate from these cities was 14.8 per thousand population for the last week in February. This is the highest death rate reported for that week since 1929. Health authorities here do not see any correlation between the high death rate and the prevalence of scarlet fever, influenza and meningitis, however, and are unable to offer any cause for the increase.

BEAVER living in the Interstates Palisades Park have had a hard time of it during the past winter. The ice froze so deep on their ponds that their natural food supply was completely locked away from them, and they were in danger of starving. In the emergency, William H. Carr, of the American Museum of Natural History, bored holes through the tops of the beaver houses and poured in grain. Through a small peep-hole which he made in one house he could see the animals hungrily devouring this unusual food.

WILDLIFE in the remote Voksh Valley, near the border of Afghanistan, is migrating. Antelope, wildcats, foxes and pheasants have been seen leaving the region in great numbers. This disturbance in the life-ways of the animal population of the valley is held to be due to the noises of civilization. About a quarter of a million acres of fertile land have recently been put under irrigation there, and the valley re-echoes with the disturbing din of trucks, tractors and excavating machinery.

THE scenic Longhorn Caverns of Texas were visited by prehistoric Americans. This is the deduction from ancient souvenirs of men found in the caverns by Dr. Charles N. Gould, geologist of the National Park Service. Making allowance for the fact that the caves are of the "trap cave" type into which animals and objects can fall, Dr. Gould said that "Longhorn Caverns bear every evidence that they once served as shelters and probably as homes for prehistoric man." The caverns to-day are a state park, noted for their fantastic stalactite and crystal formations. Dr. Gould is continuing his study of the geologic formations, and hoping for further evidence of prehistoric occupation.

APPENDICITIS is more prevalent among adolescents and young adults than among others, and much more frequent among men and boys than among women and girls. This is one of the conclusions to be drawn from a report of three Cincinnati physicians, Drs. Mont R. Reid, D. Henry Poer and Paul Merrell, who have recently studied the records of about 3,000 cases of appendicitis admitted to Cincinnati General Hospital. Details of their study appear in *The Journal of the American Medical Association*. It does not pay to trifle with the disease or to delay surgical treatment. These physicians say that the appendicitis death rate is going to remain high as long as persons are not operated on earlier. When there is delay, complications are more frequent and the hospital stay must be longer. The average time that elapsed in the 2,921 cases was 3.8 days between the first symptoms and admission to the hospital—much too long for proper surgical treatment.

No danger of feet slipping, or of rugs skidding on floors waxed with the non-slippery floor wax for which a patent was recently granted to a Brooklyn, N. Y., inventor. The wax is claimed to give a hard, continuous film capable of yielding a high, lasting, semi-transparent polish. Its novel characteristic is a "higher coefficient of friction," which means that it is less slippery than conventional waxes. Tests carried out by the inventor, using sole leather against wood waxed with the new product, indicate that a floor would be less than half as slippery as it is with conventional waxes. This non-slip property is obtained by adding to the mixture of beef wax and carnauba wax generally used in making floor waxes about 10 per cent. of high grade light-colored raw rubber.

PORCELAIN dinner sets and other fine ware may one day be a product of the Tennessee Valley, as the result of large deposits of kaolin in North Carolina, plus the development of low-cost electric power. TVA chemists are now experimenting with electric-heated kilns, hitherto considered economically impracticable, and the results thus far obtained are considered hopeful. Developments will be made available to the industry. Private manufacturers who have been testing the North Carolina primary kaolin predict that there will be little difficulty in substituting this domestic porcelain mineral for kaolin of foreign origin.

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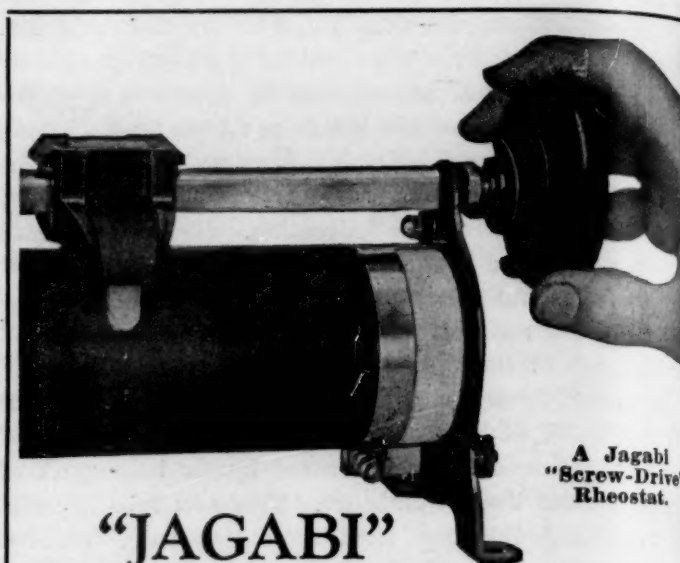
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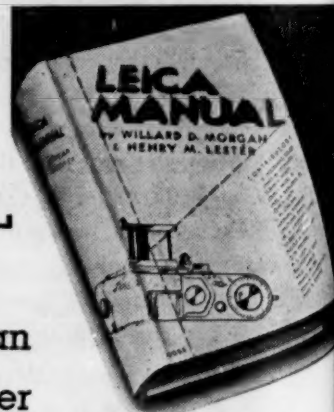
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(To be published April 2)

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in Biology, Photochemical Reactions, Effects of Radi-
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Prepared by a staff of specialists under the auspices
of the Committee on Radiation, Division of Biology
and Agriculture, National Research Council

Edited by Benjamin M. Duggar
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SCIENCE NEWS

Science Service, Washington, D. C.

INFLUENZA IN ALASKA

THE Alaskan influenza epidemic of early 1935 traveled as fast as the planes traveled. Influenza reached Fairbanks on January 15. There were 500 cases and five deaths, the latter due to post-influenzal bronchopneumonia. Nome came next. There is air travel between Nome and Kotzebue every ten days in winter. No one died in either of these towns but the sickness rate was extremely high.

On April 8, a party of three men left Fairbanks by air for Point Barrow, going by way of Kotzebue, where the epidemic was on in full force. On April 15, influenza appeared in Point Barrow. Fifteen persons, mostly old Eskimos, died in Point Barrow out of a total population of 300.

A party of Eskimos left Point Barrow for Wainwright by dog sled. Ten days later there was influenza in Wainwright. Most of the 200 Eskimos who lived there got it. None of them died, probably because each was required to remain in bed in his igloo until he recovered. Point Hope, another little town, had no visitors from the outside during that period and so had no influenza.

The doctor at Point Barrow collected throat washings from his influenza patients, preserved them in 50 per cent. glycerin, and sent them, on request, to the Johns Hopkins Hospital, Baltimore. Two Philadelphia physicians, sent by the University of Pennsylvania School of Medicine, flew to Kotzebue to collect serum and virus. They made the round trip of 11,000 miles in fifteen days and collected seventeen samples of serum. By the time the doctors reached Alaska, however, the disease was past its acute stage and no virus could be collected.

These two physicians, Dr. Horace Pettit and Dr. D. Sergeant Pepper, and another Philadelphia scientist, Dr. Stuart Mudd, tell the story of the Alaskan epidemic in the *Journal* of the American Medical Association.

A fourth investigator, Dr. Thomas Francis, Jr., has found that the Alaskan influenza virus is immunologically identical with the virus recovered by him from the Philadelphia epidemic of 1934-35. It is also identical with the British strain. The physicians conclude that the virus that has been the primary agent of human influenza in widely separated areas during recent years appears to be a single entity. It has been proved that both active and passive immunity against this virus can be established in susceptible animals. This, then, gives an encouraging outlook for the ultimate control of "this last and greatest uncontrolled pestilence."

POISONING FROM ROCK MUSSELS

MYSTERIOUS deaths that have sometimes followed the eating of rock mussels of the Pacific Coast have been traced to their true cause by the George Williams Hooper Foundation for Medical Research of the University of California, under the direction of Professor Karl F. Meyer and by Professor Charles A. Kofoid, of the University of California.

It is not the mussels themselves that are poisonous; it is "something that they ate." The blame rests with a species of one-celled animal, whose uncountable swarming numbers at times turn the coastwise waters red by day and fiery white by night—for the microscopic creatures shine with phosphorescent light when disturbed.

California rock mussels are black-shelled, orange-fleshed, delicious-flavored shellfish that grow abundantly in many places along the coast. Exceedingly good eating as a rule, they have occasionally given rise to very serious illness, marked by paralysis and sometimes ending fatally. These outbreaks of mussel poisoning apparently followed some natural cycle, but nobody could discover what it was.

Then Professor Kofoid, one of whose lifelong specialties has been the microscopic life of the sea, especially Dinoflagellata, notorious as causers of the luminosity of the ocean, noted a correlation between the mussel poisonings, which happened in 1901 during a remarkable outbreak of red water, and the swarming of one marine dinoflagellate, known as *Gonyaulax polyedra*. At his suggestion, the Hooper Foundation, with the aid of his graduate student, W. Forest Whedon, undertook a search for a dinoflagellate in the food of California mussels whose abundance might correlate with the periodicity of mussel poisoning. Mr. Whedon's studies over several years definitely proved that another species, *Gonyaulax catenella*, swarmed when mussel poisoning prevailed. A toxic substance had been isolated previously by Dr. H. Sommer from the liver of the mussels and was later obtained from this luminous protozoan. It proved to be identical with that of the mussels in their toxic phase. The shellfish, which filter minute organisms out of the water for food, just as oysters and clams do, had "loaded" themselves with the poisonous protozoans.

The fact that the organisms shine at night like fireflies makes their detection easy. A convenient safety rule is, never use rock mussels for food when the water shines round them at night.

INDIUM ALLOY FOR USE IN SURGICAL CASTS

SURGICAL casts made of alloys of the rare metal indium have been suggested as a substitute for plaster casts as the result of recent researches by Dr. Sidney J. French, of Colgate University.

By mixing substantial quantities of bismuth and lead with smaller percentages of tin, cadmium and indium, Dr. French was able to obtain an alloy which has the very low melting point of 116 degrees Fahrenheit. The alloy is physically stable, lustrous and chemically resistant.

It is the figure of 116 degrees that attracts medical attention. Such a value lies in a neat position well above possible human bodily temperatures, but not high enough to cause injury to animal tissues or even serious discomfort.

The impregnation of cloth with the alloy is proposed. Equipped with such peculiar bandage material, heated to above 116 degrees, a surgeon could manipulate a broken limb after it was wrapped. As soon as the correct placement of broken bones was accomplished under the surgeon's hands, the attending nurse would promptly fill the bandage, thus making the cast perfectly rigid solid metal.

Unfortunately the present cost of indium is too high for extensive use of the alloy. Nearly twenty per cent. of indium is required in the formula. Substantial reduction of costs may be possible, however, if real commercial applications develop. Other uses, including fingerprint and life-mask impressions, have been suggested.

This development is the outgrowth of the well-known principle that mixtures of metals—and of other solids—usually melt at lower temperatures than the separate components themselves. Somewhat similar mixtures, not including the indium, have been used for years in fusible plugs for automatic sprinkler systems.

The new surgical use for indium is described in *Industrial and Engineering Chemistry*.

LOSS FROM RUST

THERE is most alarming comment these days on the size of the public debt. It costs about a billion dollars a year merely to pay the interest on this loan. Few people, however, feel vitally concerned about the money lost because of the rusting of their property.

Dr. R. M. Burns, of the Bell Telephone Laboratories, points out, however, that this loss due to rust is approximately as large as the interest on the public debt. One of the most widely used rust preventives is paint, and 20,000,000 gallons are used annually; one gallon for every man, woman and child in the country.

In an article in *The Bell System Technical Journal*, Dr. Burns describes the various processes which occur when metals corrode. What finally happens is, of course, that the metal goes into chemical combination with something else and is thereby rendered useless.

It may seem a far cry from a rusty nail to the battery in a flashlight. But actually the formation of rust on the nail is, to a large extent, a result of the action of thousands of tiny electric batteries on the surface of the iron. Most school boys know that a battery can be made of an iron rod and a copper rod dipped into a solution of some salt or acid. If he has tried it he knows also that, as the battery is used, the iron is gradually destroyed.

The same process occurs on the surface of the metal. The metal itself and some speck of impurity on its surface are "immersed" so to speak, in a film of moisture taken from the air. The metal and the pieces of impurity are, of course, an electrical contact so that the microscopic batteries run continually and the iron is slowly but surely eaten up. It is largely for this reason that iron rusts slowly, if at all, when the air is very dry.

If a large current is drawn from an ordinary dry cell the cell gets weak. It is said to be "polarized." A thin layer of some material forms on one or both of the electrodes of the battery and it stops working. This is bad

when it happens in your flashlight but is just what scientists want to occur in the tiny corrosion cells on metal surfaces. Anything that can be done to make these cells polarize retards corrosive action. For this reason certain substances called "passivators" are added to the water in air-conditioning equipment to prevent rust formation.

SUN RAYS USED TO MAKE COLD

How sun's heat is utilized to give refrigerating cold is revealed in a U. S. patent recently granted to a New Jersey inventor. The patented invention is literally a "sun-cooled" refrigerator and may form part of an air conditioning installation.

Solar energy operates it, instead of electricity, and the hotter the sun the quicker are freezing temperatures obtained. By means of a thermostatic control it can be set to maintain a selected low temperature. "The object of the invention," states the inventor, "is to provide a cooling system . . . which may be operated without fuel cost and in sections having no available mechanical heat source other than the sun's rays."

Significance may be attached to the fact that the patent is assigned in part to a resident of Miami Beach, Florida, a region where sun rays are hot and plentiful and such a sun-operated refrigerator could be used practically all year round.

Briefly, here is how sun's heat plays its part in producing cold:

Through coils circulates a solution of water and ammonia to and from a tank. The sun's heat absorbed by the coils causes this circulation, and at the same time raises the temperature of the solution to the point where the ammonia boils off as gas.

The ammonia gas is then collected and liquefied in a condenser from which it flows through pipes to an evaporator. This is a tank-like structure containing hydrogen gas, and corresponds to the cooling coils in an ordinary refrigerator.

On evaporation the ammonia extracts heat from the space (which may be the inside of a refrigerator) surrounding the evaporator, causing the temperature to drop and thus effecting refrigeration. Hydrogen gas is put in the evaporator because the liquid ammonia evaporates more quickly in an atmosphere of hydrogen and gives faster cooling.

The cool mixture of hydrogen and the evaporated ammonia now flow from the evaporator to an absorber where the ammonia is separated from the hydrogen gas by absorption in water. The hydrogen flows back to the evaporator for further duty, while the water containing the dissolved ammonia travels to the sun-heated coils in the solar heater. Here the ammonia is again boiled off, then liquefied, evaporated and dissolved in water as before.

Once started this cooling cycle goes on continuously as long as the sun heats the coils.

A LOUDSPEAKER BURGLAR ALARM

A SIMPLIFIED burglar alarm that "hears" the burglar before he makes a sound, and goes off even before he can get to his safe-cracking tools, forms the subject-matter

of a patent recently granted to a New Jersey inventor. So sensitive is this alarm that should the burglar change the position of the tiniest object within the vault or vault room, a warning gong rings and the police dash to the scene.

A conventional loudspeaker operated by a special electric circuit serves as the "ear" of this ingenious alarm. The vibrating diaphragm of the loudspeaker sets up sustained, silent, air vibrations within the interior of the vault. Connecting the loudspeaker to an electrically operated gong-system is a balanced electrical "bridge." When setting the alarm system to safeguard the vault, this bridge is adjusted or balanced so that no current can flow from the loudspeaker circuit over the bridge to the gong-operating circuit.

In this condition, the loudspeaker diaphragm produces constant vibrations within the vault or room interior and the alarm gongs are silent. But let some one open the vault room door, step into the interior, make a tiny hole in one of the walls, or as much as change the position of an object in the room, and the nature of the air vibrations is immediately disturbed. Such disturbance breaks down the balanced set-up of the bridge, and starts the alarm circuit where it is detected, amplified and sped to a relay which works the gongs.

The inventor claims that his protective alarm is much simpler than the present-day systems used in banks, which for complete protection require specially designed locks and switches in the doors to control some alarm device, as well as alarm system networks embedded in the vault walls and sound pick-up devices in the safes to detect boring and tapping noises. His system, he says, is even more sensitive since it does not rely on the detection of any noise made by the burglar. Patent rights have been assigned to the Bell Telephone Laboratories, Inc.

ITEMS

AT Devils Lake, N. D., there was established a winter-temperature record that probably has no parallel in the weather history of this country for a first-order Weather Bureau station. At this place the temperature went below freezing on November 27 and did not thereafter rise to the freezing point until March 1, a period of 96 days. For 37 days, January 14 to February 19, there was only one day on which the thermometer registered as high as zero, while the week ending February 17 had an average temperature of 28 degrees below zero; the average for 2 months—January and February—was 13 degrees below zero.

"WHITE as death" takes on new meaning, in experiments with plant cells and ultra-violet rays performed by Dr. B. Luyet, of St. Louis University, and his collaborator P. M. Gehenio, of the Biodynamica Laboratory. They found that when the outer skin cells of an onion pass from life to death their absorption for the ultra-violet rays is lost. Living cells are black in an ultra-violet photograph; dead cells come out white. Transparency to ultra-violet rays is now used by the St. Louis investigators as a method of diagnosis of death in their further study of the physico-chemical structure of living and dead matter.

FROM a few seeds, found by chance in a fruit of the normally seedless-type Washington navel orange, a new orange variety has been originated in the Citrus Experiment Station of the University of California, and is now being offered for commercial growing. Dr. Howard Frost states that the trees will set and mature large crops in some of the drier citrus growing regions than are possible with the wholly seedless Washington navel oranges. Because of the chance finding of the original seeds, the variety has been called Trovita, which is the Esperanto word for "found." Dr. Frost also described three new citrus fruits, two of which are hybrids between separate varieties of mandarin oranges, and the third a hybrid between satsuma and a mandarin.

THE "motor" in the experimental rocket of Professor Robert Goddard yields over 200 horsepower per pound of weight, according to his new report on research progress issued by the Smithsonian Institution. Speeds as great as 700 miles an hour are developed with the Goddard rocket. By comparison the motor of a typical light motor car weighs seven pounds of engine for each horsepower developed. Modern military aircraft engines have one and a half pounds of motor for each generated horsepower. Special aircraft motors like those of the Italian racing planes have cut weight so that they need only three quarters of a pound of motor for each horsepower. The new high-speed streamlined trains powered by Diesel electric have motors weighing ninety pounds for each horsepower they develop.

"WHEN the problems of life adjustment become too great for the individual to solve, mental disability may step in as nature's way of calling a halt," Dr. C. M. Hincks, director of the Canadian National Committee for Mental Hygiene, told the Royal Canadian Institute. Viewing mental disabilities from the psychological standpoint as the result of inadequate methods of meeting the demands of life, Dr. Hincks pointed out that "such mental ailments may in reality be beneficial as they represent nature's way of working toward cure by giving the individual a breathing spell before he makes another attack upon his problems. Of course," he added, "such mental disorders, while protective to a degree, may go too far and finally end in the permanent disruption of the personality."

A GIGANTIC engineering project which will link Denmark with Sweden with a 16-mile long bridge, providing a super-high-speed highway across the island of Zealand on which Copenhagen is situated, and also span the Great Belt separating Zealand from Funen and the rest of Denmark, has been proposed by three Danish construction firms. The Danish parliament is reported to be considering the plan with favor, although its total cost will be 628,000,000 kroner, or approximately \$150,516,000. Construction would employ 12,000 workmen during a ten-year period. Especially favored by Scandinavian industrial and business circles is the 16-mile long bridge which would join Copenhagen and Denmark and Malmoe in Sweden, across the Ore Sund. Its estimated cost of \$33,744,000 would be borne jointly by the two countries.

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562 pages; 6 x 9; \$4.00. Published February 1936.

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SCIENCE NEWS

Science Service, Washington, D. C.

A GREAT STELLAR EXPLOSION

SEVEN million years ago a terrific outburst occurred in the distant part of the universe that astronomers know as the "nebulae of the Virgo cluster." At the Mount Wilson Observatory, in California, there has been discovered this gigantic stellar event which astronomers call a "super-nova," an extraordinary new or temporary star. It is one of the most energetic star explosions ever recorded by astronomers, and so remote that news of its happening, *via* light waves, has just arrived on earth.

So faint that the world's largest telescope, the 100-inch on Mount Wilson, was needed to record its brief rise to fame and fall to obscurity, the super-nova nevertheless at its maximum gave off thirty million times as much light as our sun. In the brilliant explosion, the star attained a velocity of expansion of 3,700 miles a second or more than 13,000,000 miles an hour.

Dr. Edwin Hubble, astrophysicist of the Mount Wilson Observatory, known for his discoveries of distant galaxies of stars, and Glenn Moore, assistant on the 100-inch telescope, discovered "super-nova Virginis, 1936," as the star will be called. For seven years they had been patiently searching among the nebulae of the Virgo cluster for such a stellar outburst. The rarity of such a happening in the heavens can be realized by the estimated frequency of one super-nova per nebula or galaxy of stars in each five hundred to a thousand years. Thus seven years was a short period of searching.

The outburst happened in the nebula listed in astronomical records as NGC 4273. The star affected is 29 seconds of arc from the nucleus or heart of this nebula. First photographed on January 21, it attained, on February 16, its maximum of astronomical magnitudes ranging 14 to 15.4. Then it faded rapidly.

The tiny pinpoint of light, while an exploding star, is so faint as viewed from the earth because it is so distant from us. By other observations, astronomers estimate that the nebula in which the super-nova is located is so remote that light takes seven million years to travel from there to the earth. Light is the speediest thing in the universe, traveling 186,000 miles per second, or six million times a million miles per year. Multiply this latter figure by seven million and you have the mileage from here to the extraordinary new discovery.

The super-nova has now faded from view even through the largest telescopes. It will probably never be sighted again. But it has won a secure place in astronomical records and study of its light spectra is expected to give more information on the way the universe operates.

Famous among the rare super-novae of the past is Tycho's star, which appeared in November, 1572, and was for some days visible in daylight and brighter than Venus at her best. Another temporary star, observed by Kepler in 1604, was as bright as Jupiter and remained visible for two years. These were much closer to the earth than the super-nova just discovered and were therefore seen with unaided eyes.

Latest of novae or temporary stars, but not in the super class with the latest Mount Wilson discovery, was Nova Herculis, which burst forth shortly before Christmas, 1934, and became easily visible in the northwestern evening sky. The super-nova in Virgo just observed probably put forth some two thousand times the energy of Nova Herculis, but the latter was more brilliant only because it was closer and in our own galaxy of stars.

What remains of novae when they fade away is a matter of speculation. One suggestion is that they become stars consisting of neutrons with no ordinary matter in their make-up. The neutron is one of the basic building blocks of matter and it was discovered in 1934. Such a spent star of neutrons would be extremely dense. The earth's mass on the same density would be a ball less than two miles diameter.

The outburst of a nova transcends in magnitude all other known physical catastrophes. Astronomers do not know just what happens. Favorite among theories is that there is a tremendous release of energy within the atoms of matter composing the star. Another suggestion is that novae occur when two stars collide.

NEW PLANETARY NEBULAE IN THE MILKY WAY

THREE large rings of star-dust, hitherto unknown planetary nebulae, have been found in the Milky Way by Mrs. Muriel M. Seyfert, research assistant at the Harvard College Observatory.

Each of them is believed to be hundreds of times larger than our entire solar system, yet they are so far distant they can be seen only through moderately powerful telescopes. Even then, the rings are not visible to the human eye but can only be detected on sensitive photographic plates where they appear as luminous rings surrounding brilliant nucleus stars. These center stars would, of course, be visible through large telescopes.

Actually the tremendous nebulae are not rings but spheres or balls of expanding gas and tiny particles, some of them probably as fine as molecules. From their appearance on plates, however, astronomers have named them "ring nebulae." Mrs. Seyfert's discoveries were made through an examination of plates taken at Harvard's station at Bloemfontein, South Africa.

While sufficient data have not yet been assembled to permit accurate calculation of the size and distance of the rings, Harvard observers believe that like most of the approximately 130 known planetary nebulae, those found by Mrs. Seyfert are several hundred light years away from the earth and have a diameter that is expressed in billions of miles.

At present, astronomers express their size in terms of the angle formed by imaginary lines drawn from the observer's eye to the top and bottom of the stellar body. By this calculation two of the nebulae have an angular diameter of about one fiftieth of a degree. The third nebula is about one half this size.

Astronomers also believe that the rings have a density similar to that of other planetary nebulae—a density 1,000,000,000,000,000 times lighter than air. So rare is the atmosphere of the rings that, although only 12.5 cubic feet of air weigh a pound, it takes approximately 100,000 cubic miles of planetary nebular space to give the same 16 ounces.

The density is considerably less than the most perfect vacuum obtainable on earth, yet the ring nebulae are so tremendous, their total mass is measured in millions of millions of millions of millions of tons. This would be a figure followed by at least 24 zeros.

The newly discovered rings are located in the southern constellations of Norma, Carina and Ara. The nebulae of the first two are larger while their center stars have a brightness magnitude of 13.6. The Ara nebula is even more brilliant, having a magnitude of 11.9. An unusually perfect ring shape marks the Norma body.

Planetary nebulae, whose origin and place in the scheme of cosmic evolution is one of the unsolved mysteries of astronomy, are comparatively rare. From their appearance astronomers know that each is composed of a bright nucleus star enclosed in concentric spheres of expanding gas and small particles which give off light when excited by the center star, and it is thought that they may be the result of the catastrophic explosion of novae, or new stars like the famed Nova Herculis, which occurred hundreds of years ago.

FLOODS AND DUST STORMS

(Copyright, 1936, by Science Service)

NATURE has again been good enough to warn us, by a perfectly synchronized drama of dust-storms in the West and disastrous floods in the East, of the wrath that is brewing against our western civilization unless we mend our ways. The two extremes, seemingly unrelated, are absolutely facets of the same picture.

The dust-storms are not simply a matter of unavoidable drought, but a result of the destruction of the living sod which alone can bind the looser soil types of the semi-arid high plains. This destruction has had a two-fold source. The range has been stubbornly overloaded with cattle almost ever since the extermination of the great buffalo herds. Wise cattlemen know the danger of this, but the pressure to liquidate their heavy debts often leads them to take a disastrous chance. The sod, cropped too close, affords too little protection against the prevalent winds of late winter and spring.

Even more serious is the second source of trouble—the attempt to farm the high plains in wheat, using power machinery. Even this year, with the somber warnings of last year's dust storm, there have been men who continued the losing gamble—one operator for example having set out not less than seven thousand acres of wheat. The wheat is as a rule unable to gain sufficient foothold during the winter months to protect the soil. Comes spring with its high winds, and the terrific dust-storms arrive.

What has this to do with the destructive floods now under way throughout the East? Recently, traveling through the oldest agricultural states of the Union the

writer has scarcely seen a place where the old top layer of soil is left. Careless methods of farming have allowed it to wash away in the past two and three centuries. The insidious thing is that this has taken place without much sculpturing of the ground, so that unless one is a trained observer who knows what the soil should be like, he is unaware of the profound destruction that has been wrought.

It is this dark, spongy, top layer of soil—what the specialists call the A-horizon—which is our only effective protection against flood. One can build dams downstream, construct mazes of levees and ditches, and still not touch the source of trouble. The water must be caught where it falls, and the one thing that can arrest it and hold it in place is the dark A-horizon of the soil. This layer has been made into a perfect sponge by ages of accumulation of plant material. It will retain the water, filter it, and slowly release it in a limpid stream.

Unless we take measures, through proper use of the soil, to restore this layer—no easy task—we may expect a recurrence of disaster every time there are continued heavy rains. The problem is more a matter of biology than of engineering, and the sooner we realize it the better. Our present tactics, if we could really see them as they are, would make the wise men of Gotham blush.

Modern medicine has learned that pestilence is easier to prevent than cure. Proper land management will vaccinate our land against future floods. Nothing else will.—PAUL B. SEARS.

AMEBIC DYSENTERY IN TEMPERATE ZONES

AMEBIC dysentery used to be considered a disease of the tropics only. Since the extensive outbreak in Chicago in 1933, physicians and health authorities have found that it may and does occur in temperate zone regions as well as tropical ones. It is estimated that from 5 to 10 per cent. of all the people in the United States are infected with the disease.

The disease is spread by contaminated food and drinking water. Consequently health authorities now realize that during emergencies when water purification systems may break down, they may have not only typhoid fever and diarrheal diseases to combat but also amebic dysentery. In normal times there is always danger of the disease being spread by healthy carriers of the germ that causes it. Such persons should not cook or otherwise handle food, as they may in that way spread the disease to healthy persons.

The germ of amebic dysentery is quite large and has the scientific name, *Entameba histolytica*. It gets into the body with contaminated food or water, attaches itself to the lining of the intestinal tract and gives off daughter cysts. These are excreted from the body and, if they get into food or drinking water, start the disease in the next person.

The germs of the disease may live in the body for months without producing serious symptoms. They may reach other organs besides the intestines, particularly the liver, and cause dangerous abscesses. There are several potent remedies for amebic dysentery but they must be

used under the direction of a physician. Among the drugs used are chiniofon, carbasone, vioform and emetin.

The disease usually starts suddenly with severe abdominal pain, nausea, vomiting and chilly sensations. Sometimes it starts more gradually with mild diarrhea. There is little or no fever. The diagnosis is made by examining the excretions under the microscope to determine the presence of the ameba.

Prevention of the disease depends on proper safeguards of water and food supplies and examination of food handlers in public eating places. If the water supply becomes heavily contaminated with the germs of amebic dysentery, it is necessary to boil all the water. Chlorination, which takes care of ordinary bacteria in water supplies, would not then be practical because so much chlorine would be needed to destroy all the cysts of the amebae that it would make the water unfit to drink.

EARLY SPRING

WHEN the sun crossed the equator on its northward journey on March 20, at 1:58 P. M., Eastern Standard Time, spring officially began. Not this century has it started as early, though before 1900 it frequently began even earlier, and in 1896 actually commenced at about 10 P. M., Eastern Standard Time, on March 19.

Because the year does not contain an exact whole number of days, but nearly 365 $\frac{1}{4}$, the crossing of the equator occurs about a quarter of a day later each year. But every fourth year is usually a leap year, and this shifts it back again. The length of the year over 365 days, however, is about 11 minutes less than a quarter of a day, which means that each leap year it shifts back to an earlier time than it was before. This was the error of the Julian calendar, which Julius Caesar established in 45 B. C. By 1582 it had accumulated to 13 days, when the vernal equinox, the beginning of spring, came on March 11.

In that year Pope Gregory XIII set the calendar right, by omitting ten days completely from the calendar, which brought the equinox to March 22. This had been its date in 325 A. D., at the time of the Council of Nicaea, which had set the rule for determining the date of Easter. To keep it right, he ordered that century years should only be leap years if they were evenly divisible by 400.

Thus, in 1899, the equinox occurred on March 20, at about 3:00 P. M., Eastern Standard Time. Since 1900 was an ordinary year, it occurred then at about 9:00 P. M., Eastern Standard Time, and kept coming later until 1903, when its time was about 2:00 P. M., on the 21st, the latest for many years. With 1904 a leap year, it dropped back to the evening of the 20th again, and every leap year since then has been coming still earlier. In 1940 it will be even earlier than now, and it will keep getting earlier until 2099, because 2000 will be a leap year. In the year 2100 it shifts back again to the 21st, after having come as early, in the year 2096, as 4:00 P. M., on the 19th.

ITEMS

DR. S. A. WEISMAN, of the University of Minnesota, has studied the contour of normal and tuberculous chests, in which he found that contrary to previous conclusions

flat chests were not an evidence of tuberculosis, but that deep-chested people were more prone to the disease. He now reports data procured from the records of 14,844 Minneapolis school children, aged from 5 to 17. This number consisted of 7,740 boys and 7,104 girls. He used the grades given by their teachers as the basis for their intelligence. A was the highest, C next and those in the F group included all below C and the subnormals. By careful tabulations of chest measurements, heights, weights and the grades given by the teachers, he found that the A and C groups had the flat chests and the F group had the deep chest. After the age of 12 in the girls and 10 $\frac{1}{2}$ in the boys this was especially noticeable. The flat-chested children were also taller and heavier than the deep-chested.

COSMIC rays are known to be affected by the earth's magnetic field. A large part of them therefore must be particles carrying electrical charges. But are they heavy particles such as protons or light ones like electrons? Dr. W. F. G. Swann, of the Bartol Research Foundation, of the Franklin Institute, reports in favor of electrons. An experiment he has performed in collaboration with Dr. and Mrs. C. G. Montgomery, and W. E. Ramsey is described in the current issue of *The Physical Review*. High speed protons and electrons are hard to distinguish but as they near the end of their path in the atmosphere and their energy becomes nearly exhausted, it becomes easier to tell them apart. For, says Dr. Swann, "like lively old men they end their lives in a flare of increased activity." The ionizing activity of high speed particles is greatest at the end of their trajectories. With protons the end of the final burst of activity starts in some distance before the end of the path. With electrons the distance of high ionization is very short. The experiment at Bartol Foundation is designed to examine those rays which have almost reached the ends of their paths. Finding very few highly ionizing particles the investigators have decided that very few protons are present.

WHEAT's two worst insect enemies, chinch bug and Hessian fly, had varied fortunes during the severe winter just ended. In some places the cold fought on the side of the farmer; elsewhere the pests came through relatively little scathed, according to a survey of the situation by the Bureau of Entomology and Plant Quarantine. Chinch bug's drive toward the northeast, that reached its height during the drought years, seems to have been definitely stopped. In Indiana, examinations of grasses containing overwintering insects showed mortalities from 49 per cent. to as high as 98 per cent. In the chinch bug's own native territory, however, on the southern plains and adjacent parts of the western prairies, the bug was hardly even embarrassed, despite unusually long and severe cold weather. Hessian fly is threatening from Indiana to Missouri and Kansas, and in Arkansas has in places killed as much as 50 per cent. of early-sown wheat intended for pasture. In Oklahoma the fly will probably produce a heavier infestation than last year; yet serious trouble is not expected from this insect.

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SCIENCE NEWS

Science Service, Washington, D. C.

PHYSIOLOGY AND MEDICINE AT THE
WASHINGTON MEETINGS

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A METHOD of reviving hearts, that should prove valuable in surgical operations on the heart, was reported by Dr. C. J. Wiggers, Western Reserve University School of Medicine, at the meeting of the American Physiological Society. The method makes use of massage and a weak electric current. Both of these have been used before to revive hearts, but the new and important point reported by Dr. Wiggers is the order in which the two procedures are carried out. Massage first, then use countershock. Passing an electric current of about one ampere strength through a heart that is fibrillating will stop the useless twitching of single muscle fibers known as fibrillation and make all the fibers contract together in a beat strong enough to pump the blood out into the body. This was found by other scientists in previous research. The method, known as countershock, has been used to revive animals shocked by low-voltage electric currents which are one factor that causes fibrillation. Dr. Wiggers and his associates tried the electric shock method of reviving hearts that were fibrillating because of stoppage in the heart arteries. They found that the method worked, provided the stoppage of the artery was removed and the fibrillation had not lasted more than 2 or 3 minutes. After 5 to 8 minutes of fibrillation, the electric current did not stop the fibrillation and revive the failing heart, even when massage of the heart and stimulating drugs were tried. By massaging the heart before rather than after passing the electric current through it, Dr. Wiggers was able to revive 40 out of 47 dogs whose hearts had been fibrillating for as long as 5 to 7 minutes. No drugs or chemicals were needed. Dr. Wiggers believes that the method should prove of value in revival of exposed human hearts that fibrillate accidentally during the course of cardiac operations.

STARTING the life of a baby rabbit outside the body of its mother, and then "planting" the fertilized egg into the body of another female rabbit for development and birth, has given information regarding the necessary physiological-chemical state of the egg cell before it can be fertilized by the sperm cell of the male parent. Experiments throwing new light on the threshold of mammalian life were reported by Dr. Gregory Pincus, of Harvard University, before the meeting of the American Physiological Society. Dr. Pincus obtained the egg-cells, or ova, of female rabbits. In a glass dish, he added the male element, or sperm. Fertilization failed to take place unless the eggs had previously been subjected to certain physiological or chemical treatment, that "activated" or prepared them for further development. This activation could be accomplished within the maternal body, by stimulating certain nerves or by treatment with extracts of the anterior lobe of the pituitary gland. In the glass dish, the eggs could be activated by treatment

with sufficiently strong salt solutions or by warming them to a temperature of 113 degrees Fahrenheit. A little over two years ago, Dr. Pincus startled the scientific world with the announcement that he had succeeded in uniting male and female cells of rabbits in glass dishes, and then "planting" them in the bodies of other female rabbits to complete their development. Scientists and romancers alike have for years dreamed of "bottle babies" raised not only on bottles, but actually begotten and born in bottles, thereby making parenthood much easier for half the human race. In a little book called "Daedalus, or Science and the Future," published a dozen years ago, Dr. J. B. S. Haldane predicted the production of the first "ectogenetic" baby in 1951. But even with the success of Dr. Pincus it is hardly expected in so near a future.

SWITCHING a salamander's front legs to opposite sides of its body got the poor little animal "all mixed up" when it tried to crawl. The legs persisted in working backwards, while the rest of the salamander was wriggling forwards. The situation never did get straightened out. An experiment with these curious results, which casts some light on how nerves and locomotor appendages react on each other, was reported before the meeting of the American Physiological Society by Dr. Paul Weiss, of the University of Chicago. Salamanders are animals that look somewhat like lizards, but are more closely related to toads and frogs. The most drastic kinds of surgical procedure do not seem to bother them at all, so that it is possible to cut off legs, tails and other body parts and re-plant them elsewhere, almost as easily as a nurseryman making apple grafts. In the present experiments, Mr. Weiss amputated the animals' front legs, planting right legs where left ones had been, and *vice versa*. The legs took hold and grew fast, but in their new situation persisted in behaving as though they were still in their original positions, resulting in constant effort to crawl backward while the salamanders were trying to move forward. Mr. Weiss sees in this behavior support for a theory that the muscles of a limb determine the pattern of action of the nerves that supply it. The right-leg nerves were thus "specified" into left-leg action because the left leg was attached to them. Similarly, the right leg imposed right-limb action on the left-leg nerves that supplied them after the operation.

A NEW hormone from the pancreas which may greatly improve treatment of diabetes was reported by Drs. Lester R. Dragstedt, John van Prohaska and Herman P. Harms, of the University of Chicago, before the American Physiological Society. The new hormone, called lipocaine, has not yet been used clinically. It will supplement but not replace insulin. Lipocaine apparently controls the utilization of fat in the body as insulin controls the use of sugar. The diabetic patient suffers from a disturbance in the utilization of fat, so that even with insulin treatment he can not be returned to a fully normal state. The



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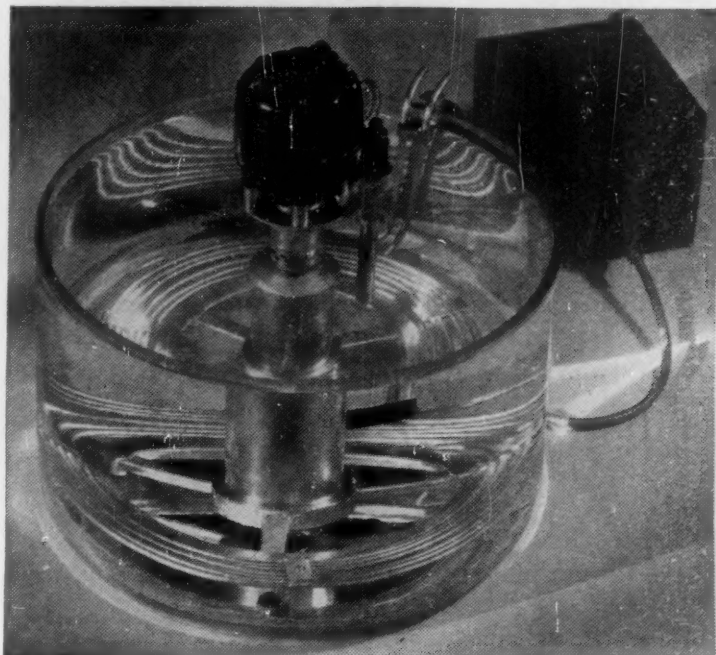
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disturbance in fat utilization often causes a premature hardening of the arteries as well as other difficulties. For this reason the fat in his diet must be more or less restricted. The new hormone was discovered in studies on dogs. When the pancreas in these animals is completely removed, they can not live more than two or three months even when given adequate amounts of insulin. At death an extreme infiltration of the liver with fat is found. Giving the new hormone together with insulin, after complete removal of the pancreas, prevented the infiltration of fat into the liver and enables the dog to live probably a normal life span. An attempt is being made to obtain lipocaeic in pure form.

THE body has a special general alarm call by which it mobilizes, within forty-eight hours, its defensive forces against poisons and other damaging influences. Evidence of this hitherto unknown defense reaction was presented by Dr. H. Selye, of McGill University, to the American Physiological Society. It involves three glands and may be due to a new adrenal gland hormone. The regiments of defense called out by the alarm, however, are located in the thymus gland, an organ in the chest which is large in children but grows smaller and may almost disappear with age. The newly-discovered defense action is like the immune reaction by which the body fights invading disease germs. But it is much faster and operates against poisons and other injuries as well as against germ infections. The routine of general alarm reaction consists of overactivity of the adrenal and thyroid glands, involution or shrinking of the thymus gland as it sends its regiments into the battle, and certain changes in the body's use of water. The reaction fails to occur when the adrenal glands are missing. It is not due to adrenalin, one well-known adrenal gland hormone, nor, apparently, to the other adrenal gland hormone, cortin.

THE idea that alcoholic drinks have a harmful effect on the liver was made less certain by Dr. J. L. Bollman, of the Mayo Clinic. With Dr. F. C. Mann, president this year of the American Physiological Society, Dr. Bollman reported studies showing that alcohol increases the fat content of the liver. The amount of alcohol which produced this effect in the dogs they studied, however, would be equivalent to a ration of one quart of alcohol a day for a man, Dr. Bollman explained. Furthermore, a fatty liver is ordinarily not harmful, although a large fat content in the liver does make it harder for that organ to cope with what Dr. Bollman termed "further insult" in the shape of certain drugs, or surgical operations. In previous studies he and Dr. Mann found that the fat content of the liver can be reduced by feeding a diet high in starch and sugar content. This is important in preparing a patient with a fatty liver for surgical operation. It also seems to put a physiological okay on the custom of eating pretzels with beer or sandwiches with cocktails. When questioned about cirrhosis of the liver, a serious condition quite different from fatty livers, Dr. Bollman said that he knew of no evidence that alcohol caused the condition.

AN extract that may prove valuable in treating hemophilia was obtained from the placenta by Drs. Arda Alden Green, Hope Lowry, R. C. Eley and C. F. McKhann, of Harvard University. Dr. McKhann had previously used an extract from this maternal tissue for treatment of measles. The one now reported is a different extract from the same kind of tissue, and seems to have the property of making the blood of bleeders clot more rapidly.

FROM the cornea of a dog's eyeballs, Dr. John H. Ferguson, of the University of Alabama, has extracted a substance which he found can play a part in the process of blood clotting. This effect of the eyeball tissue indicates, according to Dr. Ferguson, the possibility of preparing a blood-clotting agent from tissues that have no blood in them. The clotting of blood is generally supposed to depend on a substance found in the blood itself. Inability of the blood to clot normally when shed, as in hemophilia, has been thought due to the absence of such substance. He reported other experiments supporting another theory of blood clotting. This is that cephalin from the brain, as well as calcium is an essential factor in directly activating the clotting substance in blood.

A COAGELOMETER was designed at the Mayo Clinic by Drs. E. J. Baldes and K. K. Nygaard to determine the coagulability of blood in such diseases as hemophilia, obstructive jaundice and thrombocytopenic purpura, in which the blood takes a long time to clot, and in certain cases of thrombosis, or stoppage of a blood vessel by a clot, in which the clotting time is shortened. The coagelometer makes use of the photo-electric cell. Studies with this new tool of modern physics show that there are four and possibly five stages in the process of blood clotting. Clinical application of the coagelometer are under way and will be reported on later.

CLOTTING of blood within the blood vessels, which may be extremely dangerous, is due primarily to the action of tissue extract, Drs. Stearley P. Harrison and Edward C. Mason, of the University of Oklahoma Medical School, concluded from experiments made by them. They were able to produce such clots within the veins of an artificial blood-vessel system. Minute amounts of the tissue extract produced the clots when relatively large amounts of blood were circulating through the artificial blood vessels. The clots thus formed were examined under the microscope and found strikingly similar to those occurring in human disease.

THE problem of how fast the plasma protein content of the blood supply of the body can be restored to normal after extensive blood loss was investigated by the apparently drastic but harmless operation of removing all the blood and then replacing it by a salt and blood cell mixture, a sort of modified transfusion. In the case of dogs, the plasma protein is regenerated within 200 hours and in cats within 100 hours, according to experiments made by Drs. William R. Amberson, John Stanbury and Edna Warweg, of the University of Tennessee and the Marine

Biological Laboratory at Woods Hole. The operation is performed under ether and the animal suffers no pain or damage. Blood is withdrawn from the carotid artery in the neck. Into the same artery is then injected a salt solution containing in proper proportion the blood cells of another cat or dog. This is continued until examination shows that all the plasma, or liquid constituent of the blood, has been replaced by the salt solution.

THE specific gravity of blood is greater during excitement than when one is calm, and the spleen, a red blood cell factory in the body, is partially responsible, experiments by Drs. L. B. Nice and H. L. Katz, of the Ohio State University, show. Specific gravity gives the weight of a unit volume of blood or other fluid compared with the weight of the same unit of water. The effects of excitement on pigeons, rabbits and cats have been studied. In normal animals the increase in specific gravity of the blood after they had been excited was quite marked, but in rabbits whose spleens had been removed this increase was much smaller. The results are ascribed to the removal of water by body tissues from the blood, the addition to the blood of the waste products of the animal's speeded-up life processes, and most important, the actual contraction of the spleen to force red blood cells into the blood stream. Since the red blood corpuscles carry oxygen from the lungs to points where it is needed, this makes more oxygen available to the muscles, nerves and glands, so that it is possible to act more quickly and more forcibly in response to whatever it is that is producing the fear, rage or other emotion.

A NEW rôle for vitamin B, helping the body to gain weight by building up fat, was suggested by experiments reported by Drs. Dorothy V. Whipple and Charles F. Church, of the University of Pennsylvania School of Medicine, at the meeting of the American Society of Biological Chemists. Animals given diets that contained no fat but plenty of vitamin B were able to gain more weight than their mates on the same fat-free diet but without the vitamin. Comparing the average body composition of the animals, it was found that fat accounted for half the gain in weight made by the animals on the vitamin diet. Water accounted for the other half of the weight gain. The figures suggest the possibility that vitamin B plays a rôle in the building up of fat in the animal body. Vitamin B is found in moderate amounts in most natural foods, but its chief sources are wholemeal cereals, yeast, peas, beans, egg yolk, nuts, liver, kidney and heart. Lack of this vitamin causes beri-beri, a disease mostly found in the Orient, but which can occur anywhere if this vital food factor is omitted from the diet. Consequently, fat persons can not hope to lose weight by omitting vitamin B from their diet, even if the investigations reported are confirmed and the vitamin is found actually to be important in weight-building. But thin persons wanting to gain weight may in the future be advised to add liberal amounts of the vitamin to their diet.

A WAY to prevent the dental condition known as mottled enamel which has disfigured thousands of children in the Southwest and certain other parts of the country was suggested by Dr. George R. Sharpless, of the Henry Ford Hospital, Detroit, at the meeting of the American Institute of Nutrition. If the human body reacts toward aluminum compounds as the rat's does, a preventive for the disfiguring tooth condition may have been found. All that would then be necessary would be to add the right amount of aluminum chloride, which is a salt, to the diet of infants and children in regions where the water supply is high in fluorine content. Mottled enamel is caused by fluorine in the water used for cooking and drinking. As little as one part per million of fluorine in the water will cause the condition, for which there is no cure. So far, there has been no practical preventive either. A few communities have been able to solve the problem by changing water supplies, but most communities where the water supply is high in fluorine content are located in the arid Southwest where there is no other water available. Working with rats, Dr. Sharpless found that he could prevent the dental condition resulting from fluorine by adding aluminum chloride to the animals' diet. The result is achieved by a chemical reaction in which the aluminum combines with the fluorine to make a compound, aluminum fluoride. Aluminum compounds are not absorbed by the rat, so when the fluorine enters into compound with the aluminum it is eliminated from the body without getting a chance to harm the teeth. Other substances that form insoluble compounds with fluorine were tried but were ineffective.

A LABORATORY-MADE insecticide powder which may turn out to be a valuable remedy for bladder disease was reported at the meeting of the American Society for Pharmacology and Experimental Therapeutics. The report was made jointly by Drs. Floyd DeEds, John O. Thomas, C. W. Eddy and A. B. Stockton, of the U. S. Department of Agriculture and Stanford University Medical School. The powder, which has the name phenthiazine, was made in the Department of Agriculture laboratories for use as an insecticide. Before it was put into practical use for this purpose, it was tested on animals to determine whether it was poisonous. Its effect on these animals indicated a possible use as a urinary antiseptic. Rabbits suffering from cystitis or bladder inflammation due to infection with colon bacilli were cured by the addition of small amounts of the powder to their diet. Encouraging results in about thirty human cases of chronic cystitis were obtained with phenthiazine. In these thirty cases every kind of treatment had failed to relieve the condition. With proper scientific caution, however, the investigators point out that the new antiseptic is still in a very experimental stage and far from being ready for general application in the treatment of human disease. A plentiful supply of the antiseptic will be available as a result of laboratory synthesis made within the last few days.

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FOLLETT BOOK COMPANY, Chicago. *A Guide to Good Reading.* January 2 to October 1, 1936. Pp. 81. Illustrated.

HOUGHTON MIFFLIN COMPANY, Boston. 1936 *Spring Books.* Pp. 29.

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P. J. KIPP AND ZONEN, Delft, Holland. *Colorimetry and Nephelometry. Section E 33.* Pp. 15. 10 figures.

THE MACMILLAN COMPANY, New York. *New Macmillan Books, Spring, 1936, Final List.* Pp. 184. Illustrated.

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BERNARD QUARITCH, LIMITED, London. *A Catalogue of Books on Biology, General Zoology, Palaeontology and Geology.* No. 514, 1936. Pp. 94.

THE VIKING PRESS, New York. *First List: January-April, 1936.* Pp. 37. Illustrated.

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VITAMIN A

On January 30th, 1932, Mead Johnson & Company announced an award of \$15,000 "to be given to the investigator or group of investigators producing the most conclusive research on the vitamin A requirements of human beings." (J.A.M.A., January 30, 1932, pages 14-15.)

This award was extended on February 11th, 1933 (J.A.M.A., pages 12-13) to include an additional award of \$5,000 for a laboratory investigation "which may later serve for, or point the way toward an evaluation of the vitamin A requirements of human beings."

In accordance with the terms announced, the Judges decided (April 10, 1935) that the Clinical Award should be postponed until December 31st, 1936, and that the Laboratory Award should be divided between Dr. S. B. Wolbach, Harvard University, for his basic work on the pathology of avitaminosis A, the regeneration of epithelial tissue impaired by vitamin A deficiency, and the relationship of vitamin A to the integrity of the teeth; and Dr. Karl E. Mason, Vanderbilt University, for distinguishing exactly between the pathology of avitaminosis A and avitaminosis E, and for his contribution to the quantitative relationship of vitamin A deficiency to the keratinization of germinal epithelia.

The Judges for this award were announced February 11, 1933: Isaac A. Abt, Northwestern University; K. D. Blackfan, Harvard University; Alan Brown, University of Toronto; Horton R. Casparis, Vanderbilt University; H. F. Helmholz, Mayo Clinic; Alfred F. Hess, Columbia University; E. V. McCollum, Johns Hopkins University; L. B. Mendel, Yale University; L. T. Royster, University of Virginia; and Robert A. Strong, Tulane University.

PRESENT STATUS

Many papers on vitamin A have appeared since December 31st, 1934. Most of these have been in the field of laboratory experimentation, but, in addition, numerous publications involving clinical studies have appeared. From time to time, available abstracts of such work are sent, by the Secretary, to the Judges.

It is to be noted that the main award will be made on the basis of papers published, or accepted for publication, by December 31st, 1936.

It is the earnest hope of the sponsors of this award that the large amount of experimental work which has been done since January, 1932, will permit a true evaluation of the vitamin A requirements of human beings.

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SCIENCE NEWS

Science Service, Washington, D. C.

EXPEDITIONS TO OBSERVE THE SOLAR
ECLIPSE OF JUNE 19

ASTRONOMERS will go to Siberia and to the islands of northern Japan to view the total eclipse of the sun which occurs next June 19. Some of them will journey half-way round the world to watch the sun disappear behind the intervening moon for a time which, at its maximum, is 2 minutes, 31½ seconds.

At sunrise on June 19 inhabitants of Tripoli, in northern Africa, will see the sun come up black as the moon blocks out its light. At Athens and in Asia Minor the sun will rise in normal fashion but within a few seconds will be obscured. Thus onward with a speed that covers nearly half the world's circumference in the daylight hours, the shadow cast by the moon on the earth will sweep across the Black Sea, the southern Ural Mountains, across the steppes surrounding Orenburg and into Siberia. There it sweeps across thousands of miles to the islands on the northern tip of Japan until it finally ends far to the east in the vast expanse of the Pacific Ocean.

Starting as a narrow ribbon, the path of totality gradually widens, and the time the sun is obscured lengthens, until at the northern end of Lake Baikal at 12:30 P. M. on June 19 the path is 82 miles wide and the eclipse will last just a little more than 2½ minutes. From Lake Baikal eastward the path of totality narrows again and the time of totality shortens.

As always, astronomers are wondering whether the sky will be clear at their chosen observation points after they have traveled for thousands of miles with bulky and heavy equipment. Professor S. A. Mitchell, of the University of Virginia, who is president of the Eclipse Commission of the International Astronomical Union, estimates that the chances of clear weather throughout the eclipse track are about fifty-fifty. Where American eclipse parties will observe, however, the chances are slightly better—60 per cent. in favor of clear weather. Since 1933 the Soviet Government has collected all the available weather information, old and new, on the climatic conditions of the various possible observation points.

The largest American party will be the joint Harvard University and Massachusetts Institute of Technology expedition headed by Dr. D. H. Menzel and Dr. J. C. Boyce. They will be located at Ak-Bulak which is not far from Orenburg just west of the southern limits of the Ural Mountains. The joint expedition of Georgetown University and the National Geographic Society, headed by Dr. P. A. McNally, S.J., will be stationed at Kustanai, about 500 miles east of Orenburg and just east of the southern tip of the Ural mountain range. Dr. Willi Cohn, of the University of California, will be in northern Japan with Japanese expeditions, as he was in the 1934 eclipse which occurred in the South Seas. Dr. Cohn will cooperate with Science Service in reporting the eclipse conditions from that point.

England will send two expeditions into eclipse areas,

under the auspices of the Royal Society and the Royal Astronomical Society. At Omsk will be the party of Professor J. A. Carroll, of the University of Aberdeen. A larger British party will be at Kamishari in Hokkaido, the northern island of Japan where Professor F. J. M. Stratton, of the University of Cambridge, will be in command.

RESULTS OF THE STRATOSPHERE FLIGHT

THE untold story behind the record-breaking stratosphere flight of the balloon *Explorer II* last year was given at a recent meeting of the Philosophical Society of Washington when those taking part in the experiments described their work.

Among the apparatus carried aloft in the 72,395-foot ascent of Captain Orvil Anderson and Captain Albert W. Stevens in the National Geographic Society-U. S. Army Air Corps balloon was the equipment of O. H. Gish on air conductivity from the Department of Terrestrial Magnetism of the Carnegie Institution of Washington.

The ease with which the stratosphere air conducted electrical current, said Mr. Gish, rose steadily from ground level to 60,000 feet, when it was 60 times as great as at the surface of the earth. From 60,000 feet upward, however, the conductivity was surprisingly low. The conductivity not only failed to increase but even decreased slightly. This finding may have importance for cosmic ray studies since above 20,000 feet altitude cosmic radiation is the main contributing cause of air ionization, and hence of air conductivity.

The composition of the stratosphere air was described by G. M. Shepherd, of the National Bureau of Standards. The helium content of the stratosphere air was very much too high, he indicated, to be accounted for by the separation of gases which gravity would bring about. Helium was found in a concentration of 300 parts per million of gas. Contamination of the helium samples from the helium used to inflate the balloon was anticipated and is suspected in the measurements.

The ratio of the amount of oxygen to nitrogen obtained in the stratosphere air samples is slightly different from that expected. The possible origin of these differences is still under study. If the difference turns out to be real, it would indicate that a separation of the two gases due to gravity is occurring at the altitudes reached by the balloon.

W. G. Brombacher, also from the National Bureau of Standards, reported that the automatic instruments carried aloft brought back a complete "life history" of the epochal flight in terms of barometric pressure and time. The use of the vertical camera to measure altitude, Mr. Brombacher stated, yielded results in good accord with the pressure records. The photographs are excellent. A problem which is being investigated is one to determine the effect of camera tilt on the vertical camera photographs. No results on this study are yet reported.

The strength and performance of the stratosphere balloon was described by Dr. L. B. Tuckerman, of the National Bureau of Standards. He explained the new method used in folding the bag of the *Explorer II* to overcome the forces which caused the disastrous mid-air rip in the *Explorer I* and its abrupt descent. Significance in the performance of the balloon was the use of the prepared ballast chart from which Captain Anderson could determine for any conditions of air temperature, outside and inside the balloon, what amount of ballast would be required for a safe landing. Captain Anderson then made his decisions on whether ballast should be released. One disappointment, Dr. Tuckerman pointed out, was that the clockwork mechanism driving the meteorograph inside the balloon stopped about halfway up on the ascent. Its final reading was minus twenty degrees Centigrade.

H. W. Hemple, of the U. S. Coast and Geodetic Survey, described altitude measurements on the balloon from ground stations by trigonometric calculations.

Opening the meeting and introducing the other speakers was Dr. Gilbert Grosvenor, president of the National Geographic Society, who discussed "Stratosphere Flights as Exploration."

USE OF THE HELICOPTER IN AVIATION

MECHANICAL flight by man stands upon the threshold of a new development as revolutionary and progressive as was the development of the automobile in land transportation. Just as the automobile added tremendous flexibility and convenience to land travel—flexibility far above that afforded by railroads confined to rails—so the development of the helicopter along new and scientifically sound principles will add flexibility to present-day air transportation.

This prediction, based upon exhaustive study and research, was made by W. Laurence Le Page, consulting engineer of the firm of Day and Zimmermann, Inc., in a lecture on "Flight on Rotating Wings," given before the Franklin Institute.

Mr. Le Page has designed a helicopter weighing about 3,000 pounds, which, with a 300-horsepower motor, can rise straight up at the rate of 2,000 feet per minute. The "propeller" has 170 revolutions per minute against around 2,000 in the fixed wing type of airplane. This new helicopter, Mr. Le Page estimates, will have a forward motion in the air, once it has risen, of 145 miles per hour.

It must be remembered that in Mr. Le Page's design, there is found only the rotating wing to which the power is applied, there is no vertical propeller. In the autogiro the rotating wing has no power applied to it and there is always a vertical propeller.

In Mr. Le Page's design there is also the advantage of practical silence. At the slower revolutions of the large rotating wings there is a "swish" only, and the terrific roar common to the fast-moving propellers of fixed wing planes is absent. This is an important feature in the safety of air travel when the airways become more congested. At present sight is practically the only sense that a pilot can use to detect other planes in his very near

vicinity. With the propeller roar eliminated, he could also use his sense of hearing, for the exhaust can be muffled or deadened.

In the past, the helicopters designed and built were so cumbersome that they were soon regarded as impractical. The sources of power were so heavy that the early builders experienced all sorts of difficulties that invariably ended in "crack-ups." Again, the old designers all worked with rotating wings that were rigid. The rotating wings of the autogiro are not rigid, and in this feature Mr. Le Page largely found the secret of the success of the new helicopter, by the application of old principles in a new way. The rotating wings of the newly designed helicopter, like those of the autogiro, being articulated, and not rigid, there is a tremendous lessening of stress in them.

A large propeller, Mr. Le Page pointed out, moving more slowly, is more efficient than a smaller propeller moving at a greater speed. However, the design of present-day airplanes, with the propeller in a vertical position, limits the size of the propeller, otherwise the landing gear would necessarily have to be on "stilts." However, in the newly designed helicopter, the horizontal position of the rotating wings does not limit their size.

The conception of rotating wing flying dates back to Leonardo da Vinci, and the first serious attempts by man to fly by this method date back to the eighteenth century. Developments for the past thirty years, however, have largely been in the simpler and easier problems of the fixed wing aircraft. The invention of the autogiro, however, pointed to the tremendous potentialities of flying on wings which rotate. Mr. Le Page, in his research, has advanced upon the principle of the autogiro, in that he applies power to the rotating wings.

ETHER AS AN IDEAL ANESTHETIC

ETHER, pioneer anesthetic for surgical operations, can be the ideal anesthetic for both patient and physician, in the opinion of Dr. W. N. Kemp, of Vancouver, B. C. The conditions under which ether may become ideal, surpassing the newer anesthetic agents, are described by Dr. Kemp in the *Journal of the Canadian Medical Association*.

By the method Dr. Kemp outlines the patient is assured of safety, and the twin discomforts he dreads most and remembers longest are banished. There is no uncomfortable struggling to carry out the order to "breathe deeply" of the smelly stuff. The nausea and vomiting on coming out of the anesthetic are also eliminated.

Thorough preparation of the patient for the operation and the anesthetic is the first requisite for making ether an ideal anesthetic, Dr. Kemp concludes from animal and clinical studies. "The fact that the majority of patients survive our present customary lack of preparation is no argument for its continuance," he states. For about a week before the operation, Dr. Kemp directs the patient to eat no meat, but to include plenty of starches and sugars and an abundance of vitamins and calcium or lime in his diet. This diet is supplemented with a daily dose of one and a half ounces of lactose, familiarly known as milk sugar. For five days before the operation

the patient is given a daily dose of an iodine-containing medicine known as Lugol's solution. In some cases, Dr. Kemp prescribes daily doses of an extract from the adrenal glands for five days before operation. The patient should spend the last three days before the operation in the hospital "getting into physical and environmental equilibrium." These measures, Dr. Kemp believes, are "powerful factors in preventing or decreasing post-operative nausea and vomiting and in generally improving the surgical patient's subsequent well-being."

Before being taken to the operating room the patient should be made stuporous or even unconscious by one of the modern sleep-inducing medicines such as avertin, or one of the barbiturates, or the "twilight sleep" combination of morphine and scopolamine. This makes the patient oblivious to the preparations in the operating room and he goes under the ether without knowing he has taken it.

Among special instructions to anesthetists on administration of ether, Dr. Kemp advises them immediately after the operation to use suction to remove accumulated mucus from the trachea or windpipe. This, he says, is important for lessening post-operative nausea and vomiting.

Dr. Kemp cites various studies on animals explaining why the measures he advocates are useful and reports his success with them in a series of cases at the Vancouver General Hospital. In conclusion he states: "Undoubtedly the next great advance in surgery will be in the field of pre-operative care. When this ensues and when anesthetists are trained to administer ether according to the technique outlined above, or in even better fashion, then we will have made ether an ideal general anesthetic."

ITEMS

THE epidemic reported to have attacked one fifth of Milwaukee's population is thought by health authorities as possibly being influenza or perhaps being one of a series of epidemics of intestinal disease which have baffled medical scientists for the past several years. The latter disease resembles food-poisoning, is of rather short duration and is not fatal. The symptoms are nausea, vomiting, and diarrhea. Starting five years ago, the U. S. Public Health Service began receiving reports of this mysterious malady from various localities in the Northwest and from some of the National Parks, where severe outbreaks occurred in the summer. Dr. R. R. Spencer, of the Public Health Service, was sent to investigate. Although hesitating to call this a new disease, Dr. Spencer was unable to class it with any previously known ones. Neither could he trace it to the food or water supplies in the communities he investigated.

STUDIES which may explain some of the varying results obtained in the treatment of cancer by x-ray and by radium were reported by Dr. Shields Warren, of Boston, at the meeting of the American Society for Experimental Pathology. Dr. Warren observed the way in which cells of a strain of rat cancer divided following exposure to

radium of the same dosage as is used in the treatment of human cancers. He found marked variation in the way the dividing cells of the cancer responded to the irradiation. Body tissue, both cancerous and normal, grows by process of cell division. In the case of cancer, however, the growth continues unchecked, the cancer cells overrunning the normal ones. Irradiation, either with x-rays or radium is of benefit in cancer because it checks the process of division by which the cells grow, finally destroying the cells. In the rat cancer cells Dr. Warren observed that the frequency of division dropped rapidly within an hour and a half after application of the radium, reaching its lowest point during a period from two to ten hours after irradiation. The cancer tissue then recovered partially, the cells dividing at about one-third their previous rate. This level continued for about 72 hours. From ten hours onward, the cell division shows numerous cases of abnormality.

THE anemia which frequently follows infections may be due to a disturbance of internal body processes which puts a check on production of hemoglobin, the oxygen-carrying red coloring matter of blood. Studies indicating that this is the case were reported by Dr. F. S. Robschey-Robbins, of the University of Rochester School of Medicine, at the meeting of the American Society for Experimental Pathology. Dr. Robschey-Robbins' studies seem to clear up a long-standing medical puzzle. Heretofore it has been generally believed that lack of absorption of blood-forming substances by the body as well as destruction of blood during infection were responsible for the anemia. An accidental infection in dogs that had been made anemic by being bled gave Dr. Robschey-Robbins a chance to investigate the problem. He found that infection and intoxication both markedly impaired the formation of new blood. Further studies with other animals showed that actual blood destruction is not part of the picture and that lack of absorption of blood-forming substances can also be definitely ruled out. That leaves failure of blood production as the explanation of the anemia, and the studies suggest, Dr. Robschey-Robbins said, that the failure is due to some disturbance of internal body processes connected with food utilization. The same factor, he stated, may be important in human disease.

NEW hybrid varieties of cotton, aimed at meeting Russia's peculiar cotton-production problems, have been bred at the central experiment station of the All-Union Cotton Institute at Tashkent, in Turkistan. They mature from eight to ten days earlier than the old standard cotton varieties. Since even the most southerly of Russia's cotton-growing regions in Asia is in about the same latitude as Washington, D. C., St. Louis and San Francisco, this adaptation to a shorter growing season is considered of importance. Some of the new varieties were obtained by crossing Egyptian with Peruvian cotton. They produce much larger bolls—just about double the weight of the choice, but small, bolls of Egyptian cotton.

SCHOOL AND SOCIETY

EDITED BY J. McKEEN CATTELL
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VITAMIN SYMPOSIUM OF THE CHEMISTS
AT KANSAS CITY

New studies on the vitamins were reported to the American Chemical Society, on April 8, as thirty research workers in the vitamin field described their latest investigations.

Through much research and subsequent advertising the public is generally aware that the citrus fruits are good sources of vitamin C, which is the antiscorbutic vitamin, or less technically the diet factor without which people develop scurvy. Now, however, a systematic search is being made among the common vegetables to determine their respective vitamin C values also.

Peas, it is found in experiments by G. L. Mack and Dr. D. K. Tressler, both of the New York State Agricultural Experiment Station, Geneva, N. Y., and Professor C. G. King, of the University of Pittsburgh, are a good source of vitamin C in the diet. Small-sized peas, as a general rule, are the highest in vitamin C, and the vitamin content grows less as the peas grow older.

Single exception to the rule was the variety known as the Mammoth Melting Sugar pea, which has large pods and matures late. This variety had the highest vitamin C content of any of the types examined. And strangely enough, the large pods contained as much of the vitamin as did the peas themselves.

Growing chicken tissues in glass test-tubes is the method by which Professor C. A. Elvehjem and W. C. Sherman, fellow in agricultural chemistry, both of the University of Wisconsin, are seeking to learn how vitamins play the rôle of a chemical catalyst in helping prevent disease.

Professor Elvehjem and Mr. Sherman worked with vitamin B₁ whose lack causes the disease known as beriberi, or polyneuritis. In chickens this affliction causes loss of weight and appetite, muscular weakness and eventually convulsions.

Body tissues from normal chickens and those suffering from the lack of vitamin B₁ were kept alive in test-tubes for several hours by warming them to body temperature, providing plenty of oxygen, inorganic elements and organic material from which they could derive energy.

It was found that the presence of vitamin B₁ was necessary if the tissue was to be able to use lactic acid, whose combustion in the body provides much of the energy necessary for life. The lactic acid is obtained from sugar eaten by the animal or man.

Tissues from chickens in the polyneuritic condition were able to break the sugar up into lactic acid but were unable to use these acids after they were formed. Additional tiny amounts of vitamin B₁—only two thousandths of a milligram—made this vital utilization possible.

BARRIER TO VIRUS INFECTION

A STRUCTURE between the nerves and muscles of the body which acts as a barrier to stop the passage of a disease causing virus was reported by Drs. Albert B. Sabin and Peter K. Olitsky, of the Rockefeller Institute

for Medical Research, New York City, at the joint meeting in Boston of the American Association of Immunologists and the American Association of Pathologists and Bacteriologists.

Discovery of this barrier may shed light on resistance to infantile paralysis. The studies reported were made on mice, not man, and concerned another disease than infantile paralysis. Like infantile paralysis, however, this mouse disease is caused by a virus that attacks the brain and central nervous system.

The barrier that checks passage of the disease virus does not exist in young mice. When the virus gets into their muscles it easily reaches the nerves, travels along them to the brain, and causes disease and death. Older mice, however, have developed this protective barrier and seem to have another barrier in the brain so that even if the virus reaches the brain, its progress is blocked there and the rest of the nervous system is protected against it. In infantile paralysis, it has previously been reported, the lining membranes of the nose in some individuals seem to act as a barrier blocking the passage of the disease virus. What makes the nose lining an effective barrier in some persons and not in others is not yet known. Studies such as these on the mouse disease may in the future provide the explanation. In the mouse disease, the barrier is apparently built up in connection with the aging process. While more children than adults get infantile paralysis, it does not necessarily follow that development of the barrier to the passage of the infantile paralysis virus depends on age.

According to another investigator, Dr. Lloyd Aycock, of the Harvard Medical School, resistance to infantile paralysis depends on constitutional factors that one is born with.

HEREDITY AS CAUSE OF CANCER

EVIDENCE of an hereditary or constitutional factor in the causation of cancer was presented and attacked at the Boston meeting of the American Association for Cancer Research.

The genealogy of a cancer family of 305 members was presented by Dr. C. V. Weller, of Ann Arbor, Mich. Starting with the founder of the family, a man who died of cancer at the age of sixty, Dr. Weller traced the appearance of the disease in succeeding generations. In the first three filial generations there were 41 cases of cancer. Most of the members of the third and fourth filial generations have not yet reached an age when cancer would be likely to appear. Of the founder's ten sons and daughters, six died of cancer. In the next generation, 27 cases of cancer were found among the 54 members of that generation over age twenty-five. In the third filial generation, in which there are 104 members over twenty-five years old, only 8 cancer cases have been reported.

If a tendency to cancer is inherited, it does not follow any definite law of heredity, it was pointed out. The ap-

parent tendency for cancer to die out in the family is due, Dr. Weller believes, to the fact that the members of the family are trying to bring the family line to a close, either by not having children or by not marrying at all. Cancer is also being diagnosed earlier in the younger generations of this family because the members are alive to the situation and consult their physician for symptoms of indigestion or other disturbances which ordinary persons would disregard.

If cancer should actually be bred out of a family, it would not be likely to reappear in succeeding generations, according to Dr. C. C. Little, of Bar Harbor, Maine. Disagreeing with the idea that a tendency to cancer is inherited, another cancer authority, Dr. James Ewing, of New York City, pointed out that people inherit "living quarters, habits and even old clothes from their forebears, as well as physical constitution." Dr. Ewing does not think the assumption of a universal tendency to cancer is justifiable.

PREHISTORIC AMERICAN INDIANS SUFFERED FROM SYPHILIS

SYPHILIS was a scourge to Indians who lived on this continent long before the coming of the white man. Such is the conclusion most strongly indicated by evidence offered before the meeting at Durham, N. C., of the American Association of Anatomists. This has an important bearing on the history of medicine, for the origin of this disease has long been a disputed point. The evidence consists of disease-marked bones found by a joint expedition of Duke University Medical School and the University of Alabama, in ancient burials at Moundville, Alabama. Archeological conditions in the mounds make it practically certain that these burials were made in pre-Columbian times, and possibly a thousand years or more ago. The Duke-Alabama expedition was the first mound-exploring project in the United States to be conducted primarily for the purpose of finding out what diseases afflicted mound-builders. Syphilitic lesions, as nearly unmistakable as can be judged from the examination of bones alone, mark many of the skeletal remains laid out in the exhibit viewed by the anatomists. These consist largely of thigh bones, but include skulls and other bones as well. They have the swollen, overgrown, loose textured, "rotten" appearance characteristic of bone syphilis in an advanced stage. There are one or two other bacterial infections that can have somewhat similar effects on bones but a number of medical specialists who have examined these specimens agree that the weight of evidence points toward the diagnosis as given. Other diseases also shortened and made unhappy the lives of these long ago early Americans.

One skull, apparently of a man in the prime of life, had on its lower jaw a terrible out-growth of bone, an osteoma or bone tumor, which must have been the cause of its victim's death. Another smaller skull had a mal-erupted tooth breaking through the bone alongside of the nose. Other bone-diagnosed afflictions included rickets, osteomyelitis and fractures. What ills the flesh of these Indians was heir to, we can only guess, since nothing but their skeletons remain. But if the bones form a fair

sample, life in ancient Redskin America was probably far from idyllic.

THE CHANGE FROM CRUB TO MOTH

HITHERTO, relatively little attention has been paid to the physiological processes that accompany the change from dormant pupa to the winged, active butterfly or moth that emerges. They knew, of course, that the seeming death was not real; the pupa or chrysalis was not dead but only asleep. But the details of the waking, in the greatly changed form, have until now not been adequately investigated.

However, researches at present in progress at Brown University have begun to clear away some of the mystery and bid fair to bring more facts into the daylight. Professor Ivon R. Taylor, of the department of biology, is applying the methods of chemistry and physics to large numbers of moth pupae, and is learning some of the secrets of the really active life that goes on beneath the surface of the rigid, sarcophagus-like chrysalis-case while the animals are so still that they appear dead.

Professor Taylor uses bee-moths as his "insect guinea-pigs," because they are very easy to raise in large quantities and easy to handle under laboratory conditions. Results obtained with them, however, can be assumed to apply reasonably closely to the larger, showier species of moths and butterflies. Bee-moths are small insects, only about half an inch in length. They are best known as parasites on bee colonies, where their strange appetite—they feed only on beeswax—makes them a destructive and dreaded pest. But that very adaptation to crowded living, and the ease of feeding them, makes them also quite valuable in the rôle of experimental animals for the laboratory.

Life-processes go on more rapidly at the beginning of pupation in males, but in females more energy is released toward the end of the period, Professor Taylor found from very delicate tests of heat given off by the pupae. To measure this heat evolution, a special micro-calorimeter was devised. It is so sensitive that it can measure accurately the heat given off by a single pupa. One of these "moths-in-the-making" gives off enough heat during a week to raise a quarter of a thimbleful of water from freezing to boiling temperature.

PHOTOGRAPHIC IMPROVEMENTS TO BE USED BY THE ECLIPSE EXPEDITION

ECLIPSE photographs that can be enlarged 500 or 600 times, spectrographic records of infra-red rays never before caught on a plate, and a full photometric analysis of the eclipsed sun's brightness, will be among the scientific trophies which the joint expedition of Georgetown University and the National Geographic Society expect to bring home from the interior of Soviet Russia, where they will set up their instruments before "the Day," which is June 19 next.

Dr. Paul A. McNally, director of Georgetown University Observatory and leader of the expedition, outlined to Science Service some of the preparations which have been made.

The highly enlargeable photographs represent an effort

to get away from the ponderous temporary "astronomic artillery" which it has always been necessary to set up for solar photographs during an eclipse. They have been necessary because of the graininess of rapid photographic emulsions hitherto in use, which necessitated big plates taken through long focal lenses, if astronomers were to get any kind of detail to study.

Dr. McNally, using relatively short focal length cameras and fine-grained photographic emulsions, secured at the 1932 eclipse (Georgetown University total solar eclipse expedition) pictures that rank among the finest ever obtained of any eclipse. These pictures have been successfully enlarged as much as 100 times. Now, thanks to the cooperation of Dr. C. E. K. Mees, of the Eastman Laboratories at Rochester, N. Y., a still finer emulsion has been applied to glass plates for the first time. Dr. McNally hopes to obtain photographs that will enlarge up to 600 times. Such highly enlargeable photographs will permit the use of smaller, more easily carried and managed instruments, since the originals do not need to be so large.

An important part of the expedition's work will be the photographing of the sun's spectrum, or broken-up rainbow-band of light, during the eclipse. Thanks to the development of five new emulsions especially sensitive in the infra-red, photographs of this hitherto unstudied part of the spectrum will be obtained. The expedition will carry glass plates of a unique type, each one bearing all five of these emulsions in adjoining strips or zones, laid down "on the bias" to provide overlaps. The first of the emulsions is sensitive to infra-red rays up near the lower limit of the visible red, and thence they range in sensitivity down to an emulsion especially adapted to the deep infra-red rays of 12,000 Ångström units wavelength.

When the first of these infra-red sensitive emulsions was brought out, some years ago, the plates could not stand being warmed at all, and had to be kept in a refrigerator. Since then, this instability has been largely overcome.

Another set of five special emulsions, each especially adapted for one group of wave-lengths in the visible spectrum, will be used on five-by-seven-inch plates, in the equatorial-mount camera. These will give photometric measurements of the light intensity in their respective parts of the spectrum. These measurements can be used directly in technical astrophysical studies, and they can also be used as the basis for a composite color-picture of the eclipsed sun, in hues of a scientific accuracy hitherto unattempted.

Direct color photographs will also be made during the eclipse, using negatives of the DuFay process, and in addition a small motion picture camera, attached to the equatorial mounting, will make Kodachrome movies of the eclipse.

The expedition will sail April 10. They will set up their apparatus somewhere near the town of Kustanai—about 500 miles east of Orenburg, because past weather records indicate that this region offers better-than-average chances of good weather at the time of the eclipse.

It is expected that the National Broadcasting Company

will set up a station at the Georgetown University-National Geographic site to furnish details for their American listeners at the time of the eclipse. While the eclipse takes place at Kustanai at 8:40 A. M., local time, on June 19, the broadcast would reach hearers in the United States on the previous day, June 18, at about 10:30 P. M., E. S. T. Dr. McNally has been requested to speak to the American audience immediately after the eclipse.

ITEMS

RECENT weather conditions have been decidedly unfavorable for agricultural work, according to the crop summary report of the U. S. Weather Bureau of the U. S. Department of Agriculture. Where tornadoes and flood did not do damage in the southeast, heavy rains have made the soil too wet to work for spring planting. The Midwest and Northwest had abnormal cold, unprecedented in many places, which prevented outdoor operations. In the Central-Northern states the soil again became frozen with little field work possible. In some sections of the southwest it still is extremely dry with dust storms threatened.

STUDIES in Moscow of the two giant gold nuggets discovered in the Tyelguin mine in the Ural Mountains have now been completed. Their weights, as finally established, are 9,420 and 14,318 grams, respectively, or approximately 21 and 31.5 pounds. The nuggets are quite unique and have a very interesting structure. Each nugget represents a very fine transparent net consisting of lamellar, octagonal, needle-shaped and wire-shaped gold crystals forming quaint concretions. The nuggets will be sent to the Diamond Fund of the USSR.

THE recent claim that fingerprints of two individuals have been found to be "almost identical" is refuted by John Edgar Hoover, director of the Federal Bureau of Investigation, U. S. Department of Justice. A report from the State of Washington recently credited two men with having fingerprints "almost identical." "The fingerprints of the individuals in question have been examined by the identification experts of the FBI who have pronounced the impressions as readily distinguishable from one another," Mr. Hoover stated. "Such incorrect reports which may tend to shake public confidence in fingerprint identification as an accurate science, should be refuted as soon as possible."

HEALTH departments should help the private physician to care for his patients by furnishing diagnostic tests, serums for treatment, and nursing care when the patient can not pay for these items of medical care, in the opinion of Dr. Thomas Parran, Jr., given in his first interview following his installation as Surgeon-General of the U. S. Public Health Service. "A very important phase of public health work is the furnishing of aid to private physicians in helping them to practice preventive medicine." Physicians who serve indigent patients, whether in their homes or in clinics, should be paid for their services. Dr. Parran declined, however, to discuss medical-economic problems further, saying he has no prescription for meeting the diverse medical problems of the nation.

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SCIENCE NEWS

Science Service, Washington, D. C.

ATOMS AND COSMIC RAYS

LATEST news from the interior of the atom and the depths of space are blended in the annual report of Dr. W. F. G. Swann, director of the Franklin Institute's Bartol Research Foundation Laboratories. These laboratories are devoted entirely to the study of the nuclei of atoms and of cosmic radiation.

Perhaps it seems strange that atomic cores and cosmic rays should both be chosen as subjects for a single research program. Their connection, however, is quite intimate. First, the various kinds of cosmic ray particles are known to be identical with those particles shot out by the nuclei of radioactive atoms. Second, one way to learn about nuclei is to bombard them with high speed particles like cosmic rays; or, by watching what happens when cosmic rays themselves hit the atomic cores.

Some of the researches which Dr. Swann described were:

A cyclotron for nuclear investigations is being installed in collaboration with the Franklin Institute's Biochemical Foundation.

Dr. L. H. Rumbaugh has succeeded in separating the isotopes of lithium thereby producing the lightest solid ever before found at ordinary temperatures.

Dr. G. L. Locher and C. L. Haines are testing the Einstein mass-energy equivalence in the process whereby a gamma ray photon is converted into a pair of oppositely charged electrons. Verification has been established within a few per cent. The remaining discrepancy may furnish vital information about nuclear behavior.

Results of the recent stratosphere flight confirm Dr. Swann's theory that most of the observed rays are secondary particles knocked out of atoms of the atmosphere by the primary rays. Data from the balloon also show that the rays are strongly deflected by the earth's magnetic field.

Dr. T. H. Johnson will soon send up unmanned balloons for cosmic ray data in the stratosphere. The balloons and their equipment will probably be lost but will have, in the meantime, automatically radioed back the desired information. A feature of this equipment is a novel type of power plant for supplying high voltage to the cosmic ray counters. The entire equipment dangles on a string from the balloon. It will be falling slowly, however, during the entire flight, like the weight in a grandfather clock. The energy thus generated is used to drive a compact electrostatic machine.

An automatic cosmic ray recording equipment was sent on shipboard to Valparaiso, Chile, and return, by Dr. Johnson. The results reflect local variations in the strength of the earth's magnetic field.

Drs. G. L. Locher and L. H. Rumbaugh are examining photographic plates which were carried to the stratosphere on the recent flight. High speed electrical particles produce tracks in the photographic emulsion which can be seen with a microscope. Different kinds of particles can be distinguished by the kinds of tracks which they leave.

According to Compton and Bethe most of the rays at high altitudes should be alpha particles, but these plates say that the number of such particles is less than one per cent. of the total. At sea-level few, if any, of the rays are protons. The plates also suggest that a certain small percentage of the cosmic ray energy at high altitudes is conveyed by neutrons.

Examination of rays which have reached the ends of their paths has shown that very few of them are protons, at sea-level. (Dr. Swann, W. E. Ramsey, Dr. C. G. and D. D. Montgomery.)

The total amount of ionization produced by a cosmic ray in passing through a gas was studied by Dr. W. F. G. Swann and W. E. Ramsey with a combination of ionization chamber and Geiger counters. Dr. W. E. Danforth is studying the primary ionization (number of atoms shattered per centimeter of path by the original ray, not counting branch tracks) by determining the efficiency of Geiger counters at different pressures.

W. E. Ramsey has shown that at least 75 per cent. of all nuclear bursts accompanying cosmic radiation are produced by photons, not by charged particles.

It has been customary to say that there were two distinct types of cosmic-ray-nuclear bursts, those in which only a few particles are ejected, and those involving a very large number, thousands even, of particles. Dr. and Mrs. Montgomery have shown that no such distinct classification is possible, that any size of burst may occur, and that they probably all arise from the same kind of process.

AN EXPLOSIVE MADE FROM CORN-PRODUCT WASTES

By Science Service Chemistry Writer

AN explosive more powerful than nitroglycerine that can be made from the corn-product wastes of the nation was described by Professor Edward Bartow, president of the American Chemical Society, in an interview at the concluding sessions of the meeting of the society in Kansas City.

No mere dream is the new explosive and blasting agent which outdoes dynamite in potency. Powder companies are already investigating the new material, and if the costs can be lowered America will not only find its corn a valuable industrial commodity in the explosives field but a line of defense in time of war.

Basic material of the new explosive is a sugar-like substance, inositol, made from the waste "steeped" waters in which corn is soaked as a step in the manufacture of cornstarch. Inositol can be converted into an explosive known as hexanitroglycerine, containing six nitrogen atoms. Ordinary nitroglycerine is technically known by the chemical name as trinitroglycerine and has three nitrogen atoms.

The explosive hexanitroglycerine, Professor Bartow pointed out, has advantages over ordinary nitroglycerine because it is a solid compound instead of a liquid and

can thus be used directly as a blasting agent, like dynamite. Its explosive properties are essentially the same as those of nitroglycerine. Dynamite is useful because it is a solid material and can be more easily handled than a liquid explosive. The inherent disadvantage of dynamite is that while it contains powerful nitroglycerine, the latter must be soaked up by sponge-like, non-reacting rare earths. Thus the solid dynamite is only part nitroglycerine. The rest is absorbent material.

The basic material inositol, from which such a super-explosive could be made, has been known for many years as a laboratory curiosity. It could be purchased on the open market in gram amounts for a cost of about \$500 a pound. Working at the State University of Iowa, where he is chairman of the department of chemistry, Professor Bartow and his assistant, Dr. W. W. Walker, have improved the process for making inositol, so that the cost per pound is only a fraction of the former price. On a production basis demanded by the potential explosives market, the cost could be reduced to forty cents a pound, which would meet competitive figures.

Inositol is commonly but incorrectly called a plant sugar. Slight traces of it are found in the human body in the muscle and liver tissues. Its physiological significance to the body is yet unknown, but investigators at the University of Iowa Medical School are now studying the problem.

Almost all the inositol in the world just now consists of a stock of 25 pounds, which Professor Bartow keeps locked in a safe in his laboratory.

A HIGH-SPEED MOTION PICTURE CAMERA

A SPECIAL high-speed motion picture camera taking individual exposures at the rate of 300,000 a minute or 5,000 a second has been developed by the research laboratories of the General Motors Corporation to study the explosions of fuel inside automobile engines. The camera used in ordinary motion pictures takes pictures at the rate of 16 frames a second.

Dr. Gerald M. Rassweiler and Lloyd Withrow reported to the American Chemical Society that the new instrument can obtain the unblurred pictures of the spreading flame within an automobile cylinder even though an entire explosion occurs in only a brief fraction of a second. With the super high-speed camera, automotive engineers are able to analyze, picture by picture, the exact conditions within an automobile cylinder when a special quartz top is placed on it.

The technique is similar generally to the work of the National Advisory Committee for Aeronautics in Washington, D. C., which has been studying the behavior of fuel explosions in Diesel engines. When an automobile engine is running at 2,000 revolutions per minute—corresponding to about 40 miles an hour—single explosions are completed in 1/250 of a second. To study the flame properties, it is necessary to take some 20 photographs in this brief time, or one exposure every one five-thousandths of a second. To avoid blurring of each picture at this high rate of speed, the new General Motors' camera operates in a fashion somewhat similar to a scanning disk of a television set.

"If only a single stationary lens were used to photo-

graph the explosion flame," said Dr. Rassweiler, "the picture would be streaky and blurred. This spreading action is avoided by mounting 30 small lenses in a steel disk and arranging them so that, as each moving lens passes the stationary lens, an image of what is happening inside the combustion chamber is formed. This image moves with the film as the picture is being exposed. Blurring is thus avoided even though the picture is exposed long enough to produce a good image on a film which is moving at rates as high as 250 miles an hour."

THE CLASSIFICATION OF COAL

A NEW chemical yardstick for determining the qualities of coal was reported to the American Chemical Society at Kansas City. It allows scientists to go back through the millions of years in coal's prehistoric history and put their fingers, in a figurative sense, on long past happenings that make one kind of coal differ from another. Different kinds of coal, according to a report made by Professor H. L. Olin, of the State University of Iowa, have a strong attraction for oxygen and it is this affinity which is used as the basis for the new chemical test. Coal, Professor Olin recalled, is the fossil remains of ancient vegetation and the various kinds of coal represent different ages of this fossilizing process. Peat is a relatively young coal which has changed but little from the reeds and grasses of the bogs in which it was formed. Lignite has gone a step further in coal's life history. It has the appearance of coal but retains the woody structure of the long departed parent plants. Going up the geological family tree of coal, the various bituminous grades and finally anthracite are reached. All the while the buried coal mass is changing chemically with a loss of hydrogen and oxygen and a concentration of carbon.

Using the chemical, potassium permanganate, as the oxidizing agent, Professor Olin has made a study of various coals from the lignites of North Dakota to the semi-smokeless coals of West Virginia. The oxygen test places these coals in their order of rank as determined by other less simple methods. The new development, he believes, should prove useful in the work of establishing an official method of coal classification.

HOW WE SEE

WHY the movies appear to us to be pictures in motion rather than the rapid succession of still pictures they really are is explained by recent work from the Columbia University biophysics laboratories.

Dr. Selig Hecht, chief of the department, is well known for his studies of how we see, particularly for his researches into how the bleaching by light of a dye called visual purple, the sensitive material of the eye, results in vision. In a talk delivered to the biologists at Rutgers University he recounted a series of researches into why a light turned on and off fast enough appears to be uninterrupted. Light bleaches the dye which the eye regenerates. In darkness a larger amount of the dye is built up than in light, making the eye more sensitive. It is this which makes us more sensitive to light after being in the dark. When a light flickers fast enough, as is the case when we see motion pictures, not enough

visual purple is built up for the eye to become specially sensitive to the following flash of light; hence, no flicker is perceived. But when the light flickers more slowly, as for instance at the fifty-times-a-second of the electric light bulbs in the New York subways, enough visual purple is rebuilt in the dark periods to permit the eye to realize that there is a flicker.

Illustrating the pitfalls that await the unwary investigator are the kind of lights that had to be used. Other investigators had used broad beams of light to illuminate the eye for these experiments, and had obtained results which were difficult to interpret. The eye is not homogeneous, there being two kinds of apparatus in it for receiving the light impulses, but in small areas, one at the center of the retina, the other around its edge, these two kinds exist separately, not together as in the rest of the retina. These tiny areas were used for the experiments, illuminated with very narrow beams of light.

WHY IS A WEED A WEED?

WHY is a weed a weed? The answer may be any or all of a number of reasons, according to a survey of a hundred common weeds in the Chicago region made by Oliver Duggins, of the department of botany of Northwestern University. The main factor is the plant's aggressiveness in taking root in gardens, or other spots where it is not wanted, and in crowding out desirable plants. Mr. Duggins has outlined approximately a dozen factors that operate to produce this aggressiveness.

Although he says there are many other factors involved, Mr. Duggins has particularly studied the influence of the origin of the plant, the type of root system, whether the plant is annual, biennial or perennial; reproduction, the length of the flowering period, the number of seeds produced, the means of seed dispersal, the percentage of germination in the seeds, physical soil types frequented by the plants, whether the soil is alkaline or acid, the moisture requirements of the plant, the shade and sun requirements of the plant, the relation of weeds to man, and the arrangement of the plant's leaves and aerial parts. The fact that about 75 per cent. of the plants classed as weeds are natives of other countries, being brought over in ships' ballasts and in packages of ornamentals and medicinal herbs, is evidently an important consideration.

The dandelion can literally be called the king of the weeds, being one of the weediest of weeds, because of its large number of aggressive characteristics. Heavy tap roots which store up food will pull it through heavy winters. It is not particular about its soil, which can be rich or poor, rocky or black dirt, acid or alkaline, wet or dry. Allowing gardeners no rest, it blooms nine months out of the year in the Chicago district.

Plumes acting as sails afford an efficient means of spreading about 15,000 seeds produced by a single plant; eventually 64 per cent. or more of these seeds germinate. Even if the gardener found time to pluck all the yellow seed-producing flowers from the dandelion, the plant would grow again from its roots. Its low under-slung stem and leaves, below the reach of the lawnmower, shade and prevent competing plants near it from growing; thus it has more food for itself.

ITEMS

A FAREWELL photograph of Anteros, the newly discovered baby planet, was taken April 11 with the giant 100-inch reflector at the Mount Wilson Observatory, according to an announcement issued by the Harvard College Observatory. This last observation, taken when the magnitude of the object was only 20.5, is considered of exceptional value by astronomers because it gives them great "leverage" in calculating the planet's orbit exactly and thus is an important clue as to when the body may return to the neighborhood of the earth. Anteros, only one third of a mile across, is at present about one hundred million miles from earth, having crossed the orbit of Mars. On February 7 it was little more than one million miles distant, the nearest of any asteroid or other celestial body except the moon. At that time it was receding at the rapid rate of a million miles a day but it has now slowed down to approximately half that speed. Within a year, astronomers estimate, its speed of recession will have diminished to zero and it will then turn around and come back toward the sun—and earth—with steadily increasing speed.

ALTHOUGH it has faded, Nova Herculis, the star in the constellation of Hercules that was seen to flash out from previous obscurity at the end of 1934, is still engaging the attention of astronomers. Several months after discovery, it was observed to break into two parts, and each part seems to have produced its own spectrum, in the series of dark lines seen when its light was analyzed through the spectroscope. This is the suggestion of Dr. W. W. Morgan, of the Yerkes Observatory, writing in the forthcoming issue of *The Astrophysical Journal*. In January, 1935, two sets of these lines were observed, but at the time they were difficult to explain. When the star broke into two, one component seems to have been traveling in our direction at a speed of 530 miles per second, while the other was receding at 675 miles per second. This is the reason that the lines were seen in duplicate. The lines from a body traveling earthwards are shifted to the blue end of the spectrum, while those from a star speeding away are moved to the red. Had both pieces been traveling at right angles to the direction of the earth, their spectra would have merged.

KILAUEA, the volcano in the Hawaii National Park that periodically holds the famous lake of fire, probably will experience a period of quiet, in the opinion of Dr. T. A. Jaggar, volcanologist of the U. S. National Park Service. Dr. Jaggar, who has studied and predicted eruption of the two well-known volcanoes of Kilauea and Mauna Loa over a long period of time, believes that the spectacular activity of Mauna Loa in the closing months of 1935 so gave vent to the underground steam pressure that the return of activity to its neighbor Kilauea will be retarded. Observations at Kilauea confirm this belief, as its great pit of Halemaumau—a Hawaiian word sometimes translated "House of Everlasting Fire"—has been unusually quiet during recent months, the only activity being some sliding of material from the northeast rim.

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SCIENCE NEWS

Science Service, Washington, D. C.

A PLANT FOR POWER ALCOHOL

THE first American plant for the production of alcohol from low-grade farm produce, for use in producing an alcohol-gasoline blend motor fuel, was formally honored at the meeting of the Atchison, Kans., Chamber of Commerce.

The plant will produce 10,000 gallons of anhydrous alcohol daily from 4,000 bushels of corn. Thirty-two tons of protein cattle feed will be a by-product. Other farm products, such as low-grade oats, barley, wheat and potatoes, can also be utilized for alcohol production. The material employed at any given time will depend on the crop conditions.

The ethyl alcohol produced by the operators, the Bailor Manufacturing Company, will sell for 25 cents a gallon and the final blend of alcohol and gasoline sells for the same price as a premium straight gasoline of comparable octane rating. Standard approved denaturants will be used to make the alcohol unusable for beverage purposes.

Speakers at the meeting included scientific men from the chemical, agricultural and medical field. Dr. Arnold Osterberg, of the Mayo Clinic, Rochester, Minn., discussed the hazards of health caused by the carbon monoxide content of automobile exhausts burning straight gasolines. The much lower carbon monoxide content of the exhaust from an alcohol-gasoline blend fuel is a medical point in its favor. Dr. William Hale, consulting chemist of Washington, D. C., predicted that the establishment of the new plant in Atchison marks the dawn of the alcohol era in motor fuels. Dr. Leo Christensen, biological chemist in charge of the Atchison plant, described the benefits to the farmer from the use of alcohol as a gasoline blend. A 10 per cent. alcohol-gasoline fuel, said Dr. Christensen, has all the advantages of ordinary straight gasoline in a purely technical sense, and in addition, on the economic side, it has the merit of providing the farm with a new, untouched market for low-grade farm products which are now so nearly valueless that it is almost unprofitable to remove them from the fields. And the poorer a given crop may be for food purposes, he pointed out, the greater is the yield of alcohol from it.

RIGHT- AND LEFT-HANDEDNESS

DR. SAMUEL T. ORTON, of Columbia University, who recently gave the first of the 1936 Salmon Memorial Lectures at the New York Academy of Medicine, pointed out that right- or left-handedness of a child gives a key to which is the master half of the brain controlling the development of the all-important language abilities.

Although either side of the brain is capable of assuming charge of the language abilities in an individual, only one side actually engages in this task. The other side is either useless or at least unused. And the active side of the brain is always the side opposite to the individual's master hand.

The whole control of speech, reading and writing, and hence practically all communication of an individual with

his fellow men is concentrated in this one side of the brain.

The baby at birth starts life with no superiority of either hand or, as far as can be determined, of either side of the brain. He does have an hereditary tendency toward the development of superiority of one or the other side.

Dr. Orton stated that "the brain centers which control the language faculty are not open to the influence of training, but the handedness of an individual is." Usually the training is toward use of the right hand because most adults are right-handed, and also because of a prejudice against left-handedness as revealed in such words as "sinister," and the French "gauche."

Dr. Orton has found only three cases where right-handed children were trained to use the left hand. "In one, the mother herself became confused in facing the child across the table as to which was the child's right hand, and consistently taught the youngster to use the left, under the impression that she was training the child as a right-hander. The other two cases were those of boys trained on the left side by their fathers in the effort to make baseball pitchers of them. Both efforts failed."

Dr. Orton indicated that failure of either side of the brain to assume dominance may lead to language difficulties in the children. He said: "The existence of a series of intergrades between right- and left-side preferences in handedness, eyedness and footedness implies that comparable intergrading may exist between the two hemispheres of the brain in those areas which control language, thus giving rise to developmental disorders. The striking concurrence of left-handedness, of motor intergrading and of various types of language disorders in certain family stocks, strongly supports this assumption."

EFFECT OF THE LOSS OF AUDITORY EQUIPMENT

NATURE, in building the hearing apparatus, used a safety ratio which would meet the requirements of modern engineering standards, Dr. W. J. Brogden, of the University of Illinois, told the Midwestern Psychological Association meeting at Northwestern University.

A loss of 50 per cent. of an animal's auditory equipment reduces his hearing sensitivity by only 2 or 3 per cent. He was reporting an investigation on the hearing of cats conducted in cooperation with Dr. Edward Girden, of Brooklyn College; Dr. Fred A. Mettler, of the University of Georgia School of Medicine, and Dr. Elmer Culler, of the University of Illinois.

"It seems unlikely," said Dr. Brogden, "that a loss of 3 decibels in acuity would appreciably impair the animal's chances for survival; in which case we may properly speak of a safety factor of two. Indeed we may question whether the mortality-ratio among cats would be seriously increased by a loss of three fourths of their normal acoustic equipment, that is by a functional attenuation in hearing of 16 to 18 decibels (about 15 per cent.)."

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Sounds travel four main highways in their journey from the ear to the upper brain centers, for the impulses starting in each ear travel to both sides of the brain cortex.

Loss of one cochlea—the snail-shaped part of the inner ear essential to hearing—which closes two of the highways, is followed by a hearing loss of 3 to 4 decibels. Loss of one side of the brain cortex, also closing two highways, results in a hearing loss of the same magnitude. The experiments indicate that the left hemisphere may be slightly superior in acoustic value to the right, but there is no great difference. Loss of one cochlea plus loss of the brain cortex from the other side (closing 3 paths) results in a loss of only 16 to 19 decibels. Loss of one cochlea plus loss of the brain cortex from the same side results in a loss of only 13 to 14 decibels.

Since, in these last two cases, only a single one of the four highways to the upper brain centers remains open for the hearing impulses, the small impairment to hearing indicates a safety-factor which compares favorably with that found in other physiological systems and with good engineering practice.

TUBERCULOSIS IN THE TENNESSEE VALLEY

THE excessively high tuberculosis death-rate among white persons in the Tennessee Valley area was described by Dr. C. C. Dauer, Tulane University Graduate School of Medicine, and Dr. L. L. Lumsden, U. S. Public Health Service, at the meeting in New Orleans of the National Tuberculosis Association.

More tuberculosis deaths per 100,000 white population occur in Kentucky and Tennessee than in any other state in the country except Colorado, New Mexico and Arizona, where the death-rates are high probably because of the large numbers of tuberculous persons who go to those states from other parts of the country in search of climatic benefit.

An area of high tuberculosis mortality is found in central and eastern Tennessee and in western and north-eastern Kentucky, shading off gradually in all directions from this central zone in two broad belts. The central zone had the comparatively high tuberculosis death-rate of 92.6 per 100,000 white population, while the average tuberculosis death-rate for the United States is 57 per 100,000.

Drs. Dauer and Lumsden stated that they could find no explanation for the high tuberculosis death-rate in the Tennessee Valley area. Such factors as climate, economic status, occupation, rural and urban conditions, racial composition of the population, education, age, sex, and prevalence of other diseases were investigated, but gave no clue.

A possible clue in the vegetation and soil content of the region was suggested by the two physicians in a report just published by the U. S. Public Health Service. The area of high tuberculosis death-rate and the adjacent area of about average tuberculosis death-rate lie in the southern portion of the Central Hardwood Forest, as shown on a forestry map of the Department of Agriculture. Farther south, in a region corresponding with

the Southern Forest Pine Lands, the tuberculosis death-rate is much lower.

"Such a coincidence so far as it goes presents an interesting field for both speculation and practical research," Drs. Dauer and Lumsden state.

The difference in soil dusts, average sunshine and dew precipitation may influence the ability of the tuberculosis bacillus to survive outside the human body, they suggest. A difference in the living habits of the people, dependent somehow on the trees of the region, is also pointed out as having a possible bearing on the prevalence of tuberculosis.

Families residing in the hardwood regions with good shade trees, it was found in one survey, are much more prone to spend a good part of their time during the day in fair weather sitting out in the yard and freely expectorating on the ground under the trees where young children often play and where dew remains on the grass and fallen leaves through the early morning hours. In the pine-land regions the top soil is usually porous sand, grass is scanty and tree shading in the yards is poor or absent.

Tests with guinea-pigs under similar conditions of soil pollution with human tuberculosis germs, and study of the ability of the tuberculosis germ to survive on these different types of soils are suggested as a means of following this clue to a possible solution of the mystery of high tuberculosis death-rates in the Tennessee Valley area.

VITAMIN D AND TRICHINOSIS PATIENTS

DOSES of vitamin D may be a means of preventing death and providing relief in trichinosis, if further experiments by Drs. Franklin D. Barker and Wayne W. Wantland, Northwestern University zoologists, prove successful.

Trichinosis is a painful and sometimes fatal disease caused by eating raw or under-cooked pork that contains trichina worms. The larvae of the worms make their way from the digestive tract to the muscles. As it does with all foreign substances that enter the muscles, the body encloses these parasitic worm larvae with a coating of calcium as a protective measure. It takes from 10 to 15 months to do this. In the meantime, according to Dr. Wantland, "it seems quite probable that the more general symptoms of trichinosis, muscular pains, fever, etc., are, in part at least, due to toxic products formed by the breaking down of large amounts of muscle tissue together with waste products of the larvae. Thus a continuous inoculation of the infected host with toxins occurs."

Vitamin D, in the form of irradiated ergosterol, definitely hastens the calcification of the trichina cysts in the muscle fibers during the critical stage of trichinosis in rabbits. It is hoped to accomplish the same results with the use of the vitamin in higher animals and eventually in man.

Making use of the property of vitamin D to stimulate calcium absorption from the intestine and calcium deposition in the body, as is done in rickets, calcification of

cysts containing the parasitic larvae have been brought about in from 5 to 6 weeks.

Dr. Barker and Dr. Wantland are now trying to determine whether the calcified cysts in the muscle fibers have any deleterious effect on higher animals. There is a possibility that the particles in the tissues may cause a decrease in efficiency.

It is pointed out that it is significant that the majority of deaths from trichinosis occur from four to six weeks after infection, during that period immediately preceding, or during the earlier stages of cyst formation. It would seem that if cyst formation and subsequent calcification could be hastened this would shorten the critical period in trichinosis and more quickly terminate the disease. The treatment of trichinized rabbits with irradiated ergosterol apparently has a definite therapeutic value. It still remains to be tested in human cases of trichinosis.

INSECTS "EMBALMED" BY NEW METHOD FOR GREATER LABORATORY EFFICIENCY

THOMAS L. CARPENTER, student of entomology at the University of Wisconsin, is investigating the possibilities of preserving insects by a method which is very similar to that used by undertakers in preserving human bodies after death. His method consists of first dehydrating the insects in a solution of alcohol, and then suspending them in an impregnating solution.

While the insects are in the impregnating solution, they are placed in a bell jar and the air is slowly withdrawn, forming a partial vacuum. The reduction of pressure causes the preserving solution to force its way into the body of the insect, where it is allowed to solidify.

By this method, Mr. Carpenter hopes to be able to preserve almost any sort of insect for an indefinite length of time without having the insect shrivel and fall to pieces. Until the present time, entomologists have always preserved their specimens in a solution of alcohol and formalin or mounted them dry if their size permitted this treatment. The disadvantages of this method lay in the fact that when a great number of specimens were to be preserved in solution, a separate bottle was necessary for each specimen and laboratory shelf room soon became crowded. By using the new nitrocellulose impregnating method this will be avoided, for the specimens will be so well preserved that they can be stored in small boxes.

Cockroaches have served as Mr. Carpenter's subjects in his research during the past winter because they are easiest of all of the insects to find during the cold months. He explains, however, that the method will be universally applicable when completed.

ITEMS

BECAUSE a star exploded seven million years ago with the brilliance of thirty million suns, there is a chance that science will know more about the cosmic radiation that continuously bombards the earth from remote depths of the universe. Cosmic ray records are being studied to see if they show any relation to the gigantic stellar ex-

plosion or super-nova that was discovered by Dr. Edwin Hubble and Glenn Moore of the Mount Wilson Observatory while they observed with the world's largest telescope distant nebulae in the Virgo constellation. Some years ago Drs. F. Zwicky and W. Baade put forth a theory that cosmic rays originate when a star explodes into a super-nova. With the discovery of the great outburst of Nova Virginis there is new interest in the theory. Dr. Hubble explained that the bearing of his discovery on the theory is as yet indeterminate but that the spectra of the super-nova are being studied.

A SIMPLE process for producing permanent colored surfaces on a wide variety of metals was described before the Cincinnati meeting of the Electrochemical Society. Copper, brass, bronze, nickel, chromium, silver, platinum and iron are some of the metals which can take the brilliant and beautiful colors whose exact hue can be controlled by electrochemical processes. Dr. J. E. Stareck and Professor Robert Taft, of the University of Kansas, described how solutions of copper lactate in an electroplating bath will deposit on the base metals the colors, whose shade depends on the thickness or plating time. Violet, blue, green, yellow, orange and red can be obtained. It is probable that the color is caused by a layer of copper oxide formed on the base metal, for after the color has changed, by depositing different thicknesses, from violet to red it will go back again and repeat the range of the visible color spectrum. This indicates that the color seen is a diffraction phenomenon like a real rainbow color. It was pointed out that the permanency of such electrically deposited films is remarkable. They are so firmly attached that they resist polishing as well as the base metal. With a wire abrasion wheel the deposits are slowly removed but resist abrasion as well as nickel or imitation gold plate. The deposits will withstand weathering and salt spray tests without changing color. Potent sodium hydroxide will not affect them but they are dissolved in mineral acids.

SOUND waves, vibrating so rapidly that they are far above the range of human hearing, are now being used in a method for testing samples of steel and other metals for flaws. They belong to the class of vibrations known as supersonics, and are produced from electrically excited quartz crystals. Their rates of vibration can run into scores of thousands, or even hundreds of thousands, of cycles per second. Human hearing stops at about 20,000 cycles per second. In testing metals, the sample is ground flat on both ends. One end is set against a supersonic crystal, the other against a tiny dish of oil. The vibrations are transmitted through the metal to the oil, and throw its surface into a network of minute waves. A beam of light is projected through the oil. Striking the minute waves, it is broken up into a rainbow pattern, which can be observed on a white screen laid beneath the dish. If the metal sample is uniform in structure throughout, the pattern is steady and even, but if there is a flaw present the pattern is thrown into disorder.

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SCIENCE NEWS

*Science News, Washington, D. C.*THE WASHINGTON MEETINGS OF
PHYSICISTS

BY ROBERT D. POTTER

*Science Service Physics Writer**(Copyright, 1936, by Science Service)*

AN ULTRAMICROMETER

SCIENCE'S first chance to make measurements directly of individual atoms promises to come from a new ultra-precise measuring instrument.

An electric ultramicroscope capable of detecting displacements of less than a billionth of an inch with an accuracy to a few per cent. was described at the American Physical Society meeting at Washington by Professor J. C. Hubbard, of the Johns Hopkins University. It is believed the apparatus will be applicable to studies of atoms by direct observation.

The detecting apparatus is an electrical circuit containing a quartz plate resonator roughly similar to those used in broadcast transmitters for controlling the frequency of radio signals. The quartz plate, in the fashion used by Professor Hubbard, is extremely sensitive to small frequency changes. "A number of applications of this sensitivity to frequency variation suggest themselves, perhaps the most interesting applying to measurement of small displacements of an ultramicroscope plate in the exciting circuit."

Displacements of 10^{-9} cms (less than a billionth of an inch) have been measured to a few per cent., the accuracy depending upon the absence of mechanical disturbances. By suitable mechanical insulation it is expected that displacements less than one ten-billionth of an inch may be measured. "Such distances," Professor Hubbard explained, "being much smaller than the dimensions of individual atoms, it is believed that a number of problems of great interest in atomic and molecular physics will now be open to study by direct observation."

A NEW TYPE AIRPLANE VIBRATION

A severe type of vibration, of a kind hitherto unknown in airplanes, has been discovered in a fast, high-performance combat plane of the Nation's air forces. The cure for the vibrations—which "rattle the pilot's teeth"—has already been found and should result in improved pilot operation of the aerial fighting forces of the United States.

Dr. L. B. Tuckerman and Dr. Walter Ramberg, of the National Bureau of Standards in Washington, discovered the cause and cured the fault.

The two-blade propeller of the fighting plane, they indicated, sets up air impulses with a frequency of 3,200 per second. The wings of the airplane take up a vibration, due to air impulses, of just half as much—1,600 vibrations a second. The wings, in turn, set up vibrations in the airplane tail structure of 800 vibrations per second. Vibrations between wing and tail, in the ratio of two to one, would be dangerous if they stayed exactly that.

Actually the ratio is not quite two to one steadily, so that beat frequencies occur which sometimes cancel and at other times augment each other. It is the addition of the wing and tail vibrations which "rattle the pilot's teeth."

Two things cured the plane of its vibrations. The wing and tail surfaces were slightly altered so that the vibrations were less near the critical two to one ratio, and further, a three-blade instead of a two-blade propeller was installed. The vibration discovery, according to Dr. Tuckerman, probably is not a serious problem in a large airplane of the commercial transport type, but seems to appear only in the tiny, powerful combat planes.

Solving the problem was of tangible importance, however, not because there was any particular danger of the airplane shaking itself apart, but rather that the removal of the annoying vibration brought greater comfort to the pilot. And increased comfort means that the pilot can fly better, shoot better and do all his other flight tasks in an improved fashion.

PHOTOGRAPHING LIGHTNING

Like a nail gradually piercing a wooden board step by step under the impact of a carpenter's hammer, lightning strokes start from the clouds and finally reach the earth. This "blow by blow" description of a lightning bolt coming to the earth was secured from a motion picture study made at the University of New Mexico and the University of Virginia. Professor J. W. Beans and Drs. L. B. Snoddy and E. J. Workman described studies of lightning strokes near Albuquerque, N. M. Using cameras they found that the first flash extended half way from the cloud to the earth. A second one followed the path of the first but went six tenths of the way, while a third traveled seven tenths of the distance between cloud and ground. The fourth flash reached all the way and struck the earth. Four other flashes from the cloud to earth followed at short intervals. Successive flashes occurred one hundredth of a second apart.

SENSITIVENESS TO TEMPERATURE OF THE SKIN

The human skin of the face is more sensitive to small temperature differences than are the most sensitive thermometers, according to a report presented by Dr. J. D. Hardy and T. W. Oppel, of the Russell Sage Institute of Pathology and the New York Hospital.

The minimum amount of radiation required to stimulate the heat sensation in the skin of the face causes a temperature rise of only five ten-thousandths of a degree Centigrade per second.

Boeckman type differential thermometers, among the most sensitive instruments available, will only record temperature differences of one thousandth of a degree Centigrade, according to the thermometer calibration division of the National Bureau of Standards in Washington.

The white skin of the face was radiated with various wave-lengths of both visible and infra-red light. It was found that the sensitivity of the skin to heat varied with

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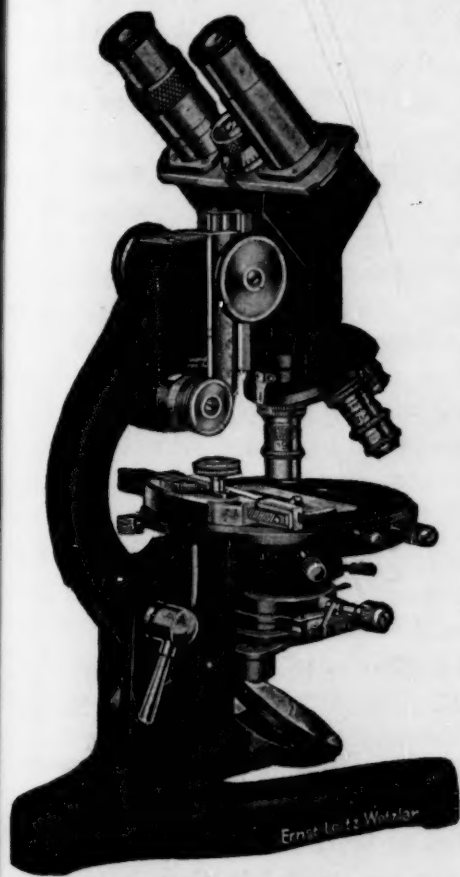
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the area exposed up to 200 square centimeters, or about 30 square inches. After this area was attained there was little increase in absolute sensitivity.

A NEW FORM OF WAVE PROPAGATION

A brief but amazing glance at scientific experiments which foreshadow what communication of the future may be like with radio waves only six inches long was presented before radio engineers and physicists by Dr. G. C. Southworth, Bell Telephone Laboratories, New York City.

Speaking, by invitation, before a joint meeting of the American Physical Society and the Institute of Radio Engineers, Dr. Southworth described his studies of a new form of wave propagation along guide lines. The electric waves used were of extremely high frequency and, indeed, beyond any wave frequencies now used for communication. The fundamental nature of Dr. Southworth's waves makes them akin, in one sense, to radio waves, but instead of being broadcast in all directions through space they travel along specially constructed guides from point to point. But before jumping to the assumption that the guiding system is like a telephone or telegraph wire it should be realized that the wave guides are like nothing so far used for the purpose in communication. Instead of consisting of electrically-conducting wires, the wave guides are composed of hollow metal tubes. The waves travel along inside nine tenths as fast as light on insulating material which will not conduct an ordinary electrical current.

The waves, being inside what is essentially a metal shield, have little external effect on near-by instruments and in turn are almost completely free from static and other noise troubles caused by outside interference. These two points alone indicate the difference between the present system and ordinary radio where interference between stations and annoyance from static are a major problem.

In his lecture, Dr. Southworth abstained from too-enthusiastic predictions about the immediate practical importance of the new system as a means of communication. The following possibilities, however, even though in the future perhaps, can not be overlooked: (1) The electric waves used are in the range of frequencies which television will use. (2) With a decrease in the size of the guiding tubes the system should be practical for long distance transmission of the waves (communication). (3) A communication electric wave system free from static and outside interference, which conceivably could be "piped" from place to place and interlace in a fashion not much different from the network of telephone wires now in use.

"The situation at present," according to Dr. Southworth, "is that the art at these extreme frequencies is not yet at a point which permits a satisfactory evaluation of practical use. However, for short distance transmission or for use as antennas or projectors of radio waves or for selective elements analogous in nature to the tuning elements so commonly used in radio, there are not the same economic conditions limiting the size of the structure. For such uses, then, structures of this type (wave guide tubes) deserves serious consideration."

The electric waves used in the Bell Laboratory experiments were 15 cms in length, or about six inches. Special types of radio oscillators, known as Barkhausen tubes, are used to generate the short waves.

For detecting elements at the other end of the experimental guide tracks, Dr. Southworth used a trap-like chamber in which was inserted a variation of the old-fashioned crystal and "cat's whisker" detector. The tiny current picked up by this detector was led to a sensitive galvanometer which measured the intensity of the current. Dr. Southworth stated that "there is no return current path, at least of the kind that is commonly assumed in ordinary transmission."

THE WILSON CLOUD CHAMBER APPARATUS

The Wilson cloud chamber apparatus, which is one of the most potent tools of science for taking actual photographs of the break-up of atoms, has been redesigned into an instrument which weighs only 76 pounds, by Dr. Gordon L. Locher, of the Bartol Research Foundation of the Franklin Institute. Hitherto, cloud chamber apparatus have been unwieldy, heavy instruments weighing hundreds and even thousands of pounds. It was in such an instrument that Dr. Carl Anderson first discovered the new atomic particle, the positron.

Dr. Locher's variation of the famous instrument was designed for the stratosphere flight of Dr. and Mrs. Jean Piccard. He constructed a similar one for the last stratosphere flight of the *Explorer II* of the National Geographic Society and Army Air Corps. It is semi-automatic in operation and is made of light-weight DOWMETAL.

The new light-weight instrument should find wide use in studies of nuclear disintegration and cosmic radiation, especially in balloon flights and for observations on high mountain peaks where it is with only the greatest of difficulty that the ordinary, heavy type of equipment can be set up.

Dr. Locher expressed the belief that one of the greatest benefits to be derived from cosmic-ray studies will be the eventual correlation of cosmic-ray nuclear disintegrations with those produced by laboratory means. He showed cloud chamber photographs of some of the 185 cosmic-ray disintegrations he has obtained in paraffin, boron and lead. Those from paraffin show paths of massive nuclear particles that do not resemble anything produced by radioactivity or by laboratory disintegrations. An explanation of their origin awaits further investigation.

CAVITATION

Intense audible sounds have been found, by Dr. L. A. Chambers, of the University of Pennsylvania Medical School, to produce visible light in fourteen different liquids in the spots where cavitation occurs.

Cavitation is the phenomenon occurring in water, for example, at the blades of swift-moving ship's propellers. Holes or empty spaces are created in tiny spots within the fluid. These evacuated spaces collapse suddenly and the liquid comes together with an impact which causes a high, momentary increase in pressure. The resulting effect in the case of propellers is a pitting and erosion

of the metal surfaces. Steam turbine blades face the same difficulty.

Dr. Chambers creates the cavitation holes in his experimental liquids by the intense audible sounds with frequency ranging from 1,000 to 9,000 cycles per second. In the regions where the cavitation was occurring he found that visible light is emitted by the liquid. An adequate explanation is still lacking but it seems probable that the atoms of the fluid are sufficiently excited in the process to emit light.

LONG LIFE RADIOACTIVITY

While it is commonly thought that artificial radioactivity is a transitory, soon-passed happening that is entirely over in a few hours or days at the most, Dr. Edwin McMillan, of the University of California, stated that a beryllium-aluminum alloy target from the famous cyclotron apparatus in Professor E. O. Lawrence's laboratory shows a radioactivity which has a minimum half life of ten years.

Last June the beryllium-aluminum alloy target of the equipment was removed after having been in use for a year. It had been used so much that even long-period artificial radioactivity had been built up. For the last four months the radioactive decay of this target has been studied and it now seems to be disintegrating at a fairly constant rate which indicates a period of half life lasting at least a decade of time.

Another part of the apparatus, composed of molybdenum and brass, was also removed and examined. It, too, had been in such a position that it had been struck by the piercing deuteron particles generated by the apparatus. From this piece another long-period radioactivity of half life of three months was found.

ERUPTIONS IN ATOMS

A phenomenon corresponding to microscopic volcanic eruptions in bits of tungsten ribbon covered with thorium, and used in vacuum tubes, has been discovered at the Bell Telephone Laboratories, New York City. A. J. Ahearn and J. A. Becker described their studies of these thorium eruptions with an electron microscope.

On heating the thoriated tungsten filaments to temperatures as high as 4,000 degrees Fahrenheit, the Bell Laboratory scientists found that the filament surface was covered with little "active" areas which erupted and migrated over the surface of the pockets of thorium. From measurements of the currents in their equipment they estimate that about 50 billion thorium atoms are involved in such eruptions. Each little pocket of thorium, they estimate from calculations, contains from 10 billion to two trillion thorium atoms.

The studies were made to determine, if possible, the process whereby the thorium atoms are distributed over the tungsten surface of the filament. This knowledge is basic in the field of filament emission in radio and other vacuum tubes.

PROTECTION FROM RAYS

The vast drive of physicists in the last few years to learn more about the secrets held within the cores of atoms has resulted in a new influx of radiation burns

caused by x-rays and the radioactive substances, either natural or artificial, with which these explorers of the atom must work. This knowledge and a suggestion of ways in which investigators can guard against such piercing radiation was presented by Dr. G. Failla, chief physicist of Memorial Hospital, New York City, where—for years—radium and x-rays have been used for the treatment of cancer and its allied diseases.

In its way the new increase in radiation burns is similar to the havoc wrought in the early days at the start of the century when x-rays and radium rays were first being used for experiment and therapy, except that the latest increase comes when the scientists supposedly have full knowledge of the dangers they face in such atomic research.

TELEVISION TESTS

Radio waves of the kind to be used in television have been flying over New York City in recent months between two of the metropolis' greatest skyscrapers, the Empire State Building and the RCA Building.

These waves, completely out of all range of ordinary broadcast receivers, have a frequency of 177,000,000 cycles a second. They are in the range used for experimental television broadcasts, according to P. S. Carter and G. S. Wickizer, of RCA Communications, Inc., before the joint meeting of the Institute of Radio Engineers and the International Scientific Radio Union. The high-frequency signals received came by several paths besides the direction one between the two skyscrapers. Some of the signals arrived after reflection off the ground and after reflections from other near-by buildings. This reflection characteristic of the high-frequency waves is typical, for it is known that they can be propagated in straight lines; have difficulty in bending around intervening obstacles; in fact, have a transmission distance limited quite largely by the curvature of the earth.

RADIO RECEPTION

Owners of the new high-powered radio receivers may get their thrill from "picking up" distant stations throughout the United States and foreign lands, but scientific men use these distant signals to study the tides created by the moon in the ionized layers miles above the earth which make such transmission possible. Dr. Harlan T. Stetson, of Harvard University, presented new facts about the moon tides in the radio reflecting layers before the joint meeting of the Institute of Radio Engineers and International Scientific Radio Union.

Dr. Stetson studied the changing intensity of radio signals between KFI, Los Angeles, and WBBM, Chicago and Delaware, Ohio, as the moon moved across the sky at night. Correlating his findings with observations made at Harvard University by Professor H. R. Minno, Dr. Stetson concludes that "these results may be interpreted as indicating that when the moon is opposite the sun there is a tendency for an increase in the ionic density on the night half of the earth's atmosphere thus favoring increased number of reflections (better reception) from the E layer." The E layer refers to one of the zones of ionized particles which reflect radio waves.

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SCIENCE NEWS

*Science Service, Washington, D. C.*THE MEETING OF MAMMALOGISTS IN
PHILADELPHIA

BY DR. FRANK THONE

PROBLEMS of fur-bearing animals, game animals and other forms of wildlife occupied a major portion of the attention of the American Society of Mammalogists, who opened their annual scientific sessions at the Academy of Natural Sciences in Philadelphia on May 8.

Mammalogists specialize on warm-blooded animals that wear fur or hair and not feathers; their interests range from mice to moose—indeed include man himself, for humans are mammals. Much of the high interest taken in the lower mammals now-a-days is due to the havoc that the "highest" mammal has wrought in their ranks by hunting, trapping, marsh-draining, forest-burning, sod-plowing and other destructive activities. So representatives of the U. S. Biological Survey, the U. S. National Park Service, various state conservation and game management bodies, as well as wildlife-studying private citizens, are having their say.

Topics really do range from mice to moose. The first scientific paper on the program is about North American shrews, which are even smaller than mice. Some species of shrews have bodies about the size of the last joint of a man's thumb. They are the smallest known mammals: many kinds of insects are bigger than shrews. And the last paper on the program is about a desert-dwelling mouse. In between, about halfway down the list, is a discussion of the moose of Isle Royale, in Lake Superior, which may some day become a national park.

OKAPI, queer-looking jungle cousin of the giraffe and one of the world's rarest mammals, is a "living fossil," 30 million years out of step with the times. This is the verdict rendered to the society by Edwin H. Colbert, research worker at the American Museum of Natural History. Mr. Colbert has made a careful examination of okapi skeletal material, and finds that though the animal is related to the modern giraffe, it is in all respects more primitive than any fossil giraffe known. He considers it to be more like what an ancestor-giraffe might have been, back in Miocene times, 30 million years ago. Although not an extinct animal, the okapi is apparently about as near extinction as a species can get, and still survive. It was never seen by white men until the beginning of the present century, when its discovery by Sir Harry Johnston, then governor of the British province of Uganda in Africa, caused a furor in the scientific world and even a newspaper sensation. It lives in the dense tropical jungle, which its extreme shyness and skill at concealing itself make its detection exceedingly difficult. Not so tall or long-necked as the giraffe, it still shows its zoological kinship in its high shoulders, peculiarly shaped head, and little nubbins of horns.

ONE of the most beautiful animals in America, the bighorn sheep, is in grave danger of becoming extinct according to field scientists who have followed their dwindled

flocks into the remote fastnesses where they have taken refuge. Joseph S. Dixon, field naturalist of the U. S. National Park Service, told of climbing up almost vertical cliffs in the Sierra Nevada, to find out whether one little band numbered as few as six or as many as fifteen. The same grave situation is paralleled everywhere in the continental United States, other field workers agreed. Only in Mount McKinley National Park, in Alaska, do the bighorn seem to have a really good chance for their lives. Their near-extirpation in the United States proper is due in part to poachers, who shoot them in defiance of protective laws, and in part apparently to diseases introduced by domestic sheep years ago. In this, the fate of the bighorn is tragically parallel to that of that other native of the American wilderness, the Indian, who, if he survived the white man's bullets, fell victim to the white man's smallpox.

ONE reason for the dwindling numbers of picturesque big game animals in our National Parks, especially in the Northwest and Rocky Mountain regions, is the loss of their pastures outside the present park boundaries. Seized by ranchers for commercial purposes, they cannot support the herds of deer and elk they once did—and the herds grow smaller. This factor in America's wildlife problem was laid before the meeting by four U. S. National Park Service naturalists: E. Lowell Summer, Adolph Murie, A. E. Borell, and Willis King. One notable case in point which they cited was that of the white-tailed deer of Yellowstone National Park. Once fairly abundant in the Yellowstone region, this species has totally vanished in comparatively recent times, due to the loss of its winter feeding grounds.

BATS, which would hardly be fancied as pets by most people, have been kept as more or less docile captives for months on end by Professor William H. Gates of Louisiana State University. He told of his experience in capturing and keeping bats of several species, and of his observations on their feeding and breeding habits. Captive bats, he found, would feed willingly on a large number of things that they cannot imaginably get in their native state. American cheese, cottage cheese, yeast, bees killed and cut into small pieces, minced insects of other kinds, bread, crackers, hard boiled eggs, any kind of vegetable, any kind of unsalted meat, milk of all kinds—sweet, sour, evaporated, buttermilk, malted milk—all these the bats fed and thrived on. They preferred cottage cheese above other artificial foods and would even drop other foods they had already picked up, if they found it available. Their preference for bees rather than other insects might appear strange at first, for bats fly at night and bees by day, so that they do not normally meet. However, Professor Gates suggested, the nectar carried by the bees may have given them an attractively sweetish taste. All the food had to be chopped up very fine, for bats are rather helpless, with both arms and legs involved in their wide "leathern" wings, and their mouths are adapted

only to the intake of very tiny morsels. Their meals must be served in very shallow dishes, as must also the necessary supply of drinking water.

APT illustration of the old adage, that "what's one man's meat's another man's poison," was presented by Adolph Murie, naturalist of the National Park Service. Or rather, what's "poison" for man is meat for bears. Last summer grasshoppers and Mormon crickets were unusually abundant in the Jackson Hole—Yellowstone region. They were so thick they made the roads slippery, and they were everywhere in the grass. Bears ate them by the bushel, even deserting their usual unsavory but favored "combination salad" of hotel garbage. Mr. Murie watched an old mother bear with a couple of cubs. About every two steps, she would stop, snatch up a fat cricket, munch it a couple of times, and move on to the next victim. Mr. Murie found evidences that the bears in that region were feeding almost exclusively on insects.

PANDA, one of the strangest-looking animals that wears fur, has been put in the same family pew with raccoons, though to outward appearance it is more like a bear. The newest effort toward a correct classification of this puzzling beast was reported by Professor William K. Gregory, of the American Museum of Natural History. The panda, which lives in the most inaccessible parts of the Himalayas, is about as big as an American black bear, and is bear-like in appearance and general habits. It is marked like nothing else alive, with black legs, a black band around its body at the shoulders, black ears and a black spot around each eye; the rest of the creature is light-colored. Professor Gregory made an exhaustive comparison of the bones of panda specimens, detail for detail, with the bones of bears and of raccoons, as well as with fossil remains of bear- and raccoon-like animals now extinct. Despite differences in size, there were more fundamental shape-resemblances between the bones of panda and raccoon.

THE CAUSE OF DEATHS BY LOW VOLTAGE ELECTRIC SHOCKS

How and why people can die from low voltage shocks on the electric lines which run toasters, vacuum cleaners and refrigerators in their homes has been described for the American Institute of Electrical Engineers after nine years of research. The amount of electric current passing through the body, rather than the voltage of the circuit, appears to be the important factor according to the joint study made by scientists from The College of Physicians and Surgeons of Columbia University and the Bell Telephone Laboratories.

Dr. H. B. Williams, Dr. B. G. King, L. P. Ferris and P. W. Spence will describe their study of the effect of electric currents on the heart at the forthcoming meeting of the American Institute of Electrical Engineers at Pasadena, Calif.

The aim of the study was to find out what happens to the heart during electric shock and under what conditions it is fatal. Using experimental animals, under an anesthetic, the scientists found that death may result from a

shock of relatively weak current lasting only a few hundredths of a second. This fraction of time is far too short to bring death by interrupting circulation and is also much too brief to think of any type of rescue.

Death in such cases is brought about by the stoppage of the heart's normal pumping action and the establishment of what doctors call ventricular fibrillation, it is found. In fibrillation the muscle fibers of the heart contract in an uncoordinated manner, twitching and quivering spasmodically in contrast to their normal rhythmic movements. If fibrillation is not stopped shortly, there results an asphyxial death within a few minutes.

It was discovered that the sensitivity of the heart to electric shock varies with the point in the heart beat cycle at which shock occurs. The brief partially relaxed period at the end of a heart contraction seems to be much more sensitive than other times. Currents of several amperes through the body, it was found, could be successfully withstood if they lasted less than one-third of the time of one heart beat and did not occur during the one-tenth of a second when the heart was partially relaxed. Also investigated was the ability of a "counter-shock" to bring a heart out of the death-bringing fibrillation. A shock of high intensity and short duration will serve as such a counter-shock. The explanation seems to be that large currents appear less likely to cause the dangerous fibrillation than do smaller ones. In other respects, as in burning, large currents are more harmful than weaker ones.

THE SEVENTEEN-YEAR CICADAS

CICADAS, usually called seventeen-year locusts, will appear from Georgia on the south to Michigan on the north, from Long Island on the east to the Mississippi river on the west, with smaller outlying swarms in Wisconsin, New England, and other border areas. Similar insects, the 13-year cicadas, will appear in a single compact area, where the "corner" of Mississippi fits into Louisiana. They are rather large insects, about the size of big bumblebees, with transparent, dark-veined wings.

They are not really locusts. True locusts, the kind that were one of the Plagues of Egypt, are long-winged grasshoppers, and are terribly destructive. The 17-year cicadas are strictly American insects, and they are usually harmless. The only damage they cause is by laying their eggs in the young green twigs of trees. This causes leaves to drop off, and sometimes kills young nursery and orchard stock. But for the most part they are more noisy than they are economically important.

The cicadas are the longest-lived insects known. After their eggs are hatched, the tiny young ones, no bigger than ants, dig into the ground, and there they live for 17 long years (13, in the Southern species), sucking sap from the roots of trees. In the late spring of the seventeenth year, they burrow to the surface, climb up the trees and bushes, split their "baby-clothes" up the back, and emerge as winged, singing insects. They live for a few weeks in the sunlight, mate, lay their eggs—and die. The brood now emerging are the orphan offspring of the brood that emerged and died in 1919.

Of the 17-year species there are 17 broods; of the 13-year species in the South, 13 broods. Each brood has its

known area, and of course its known years of appearance. This year's brood has an unusually large area. Last year's was confined mainly to West Virginia and the mountainous parts of Virginia and northwestern North Carolina. Next year's brood is known only from Massachusetts, Connecticut and Rhode Island.

The enormous numbers and the shrill noisiness of the 17-year cicadas, as they swarm in the woods, sometimes cause a good deal of alarm. Superstitious folk are also prone to think that the orange-red W-shaped mark near the tip of each wing is a sure omen of war. However, since these insects appear somewhere in this country every year, and since there is almost always a war going on somewhere in the world, the cicada's powers of prophecy are not really put to a very severe test.

ITEMS

A FIND of fossils has been reported from the region of Lake Balkash in Kazakstan, near the Mongolian border. Especially noteworthy are skeletal remains of *Noropus*, a "missing-link" animal, between horse and rhinoceros, extinct some 15,000,000 years. The Institute of Evolutional Morphology and Paleozoology is sending an expedition to explore the deposits.

AIRPLANES will attempt to find the great meteor whose fall in 1908 in Siberia felled a forest, burned an area over 35 miles in length and caused an earthquake. The meteorite commission of the USSR Academy of Sciences has announced its determination to continue the search until this meteorite, considered the largest known in the history of mankind, is actually found in the Siberian valley of the Podkamennaya Tunguska River. All attempts to find the meteorite, undertaken during the past few years by a staff member of the academy, L. A. Kulik, have so far failed. This year, the study of the area of fall will be made from airplanes. It is believed that a photo taken from an airplane in the spring when the snow vanishes and the woods are still bare, will show both the direction in which the trees fell, when swept by the fall of the meteorite, and the craters formed by the impact of the meteorite which apparently broke into several pieces during the fall.

THE newest combination instrument of science which can be used either as a microscope, a telescope or as a "lens" for focussing the tiny negative charges of electricity known as electrons was described before a joint meeting of the American Physical Society and the Institute of Radio Engineers by Dr. V. K. Zworykin, famed radio engineer of the RCA Corporation, Camden, N. J. Dr. Zworykin discussed the operation of the electronic instrument and told of some of the general improvements in design which have been made in the past few months.

Used as a lens for focussing electrons, the apparatus employs electric fields which bend the electric particles so that they can be collected into a single small spot in a fashion analogous to the collection of light rays to a focus by an ordinary optical lens. Used as a microscope the Zworykin apparatus shoots electrons at the object to be examined and the reflected electron image is properly brought to a focus and examined with an infra-red sensitive layer which in a camera would correspond to the

photographic plate. As a telescope, a large aperture lens is mounted so as to image the scene, toward which the telescope is pointed, onto an infra-red sensitive cathode of an image tube. The electron picture falling on the fluorescent screen renders visible the infra-red image. Such a device can be used to test haze and smoke penetration by infra-red and for signalling.

PLANTS can be made to grow bigger, producing a larger seed yield, by "stuffing" them with carbon dioxide, the atmospheric gas which they use as initial raw material in food-making, Dr. Earl S. Johnston, of the Smithsonian Institution, has determined in a series of laboratory experiments. Dr. Johnston grew wheat plants in open-topped glass enclosures, in which he maintained the carbon dioxide content at four times its usual percentage in the air. The plants produced more stalk and larger and more numerous heads than did similar plants in neighboring glass cages where only ordinary air was used. As yet, Dr. Johnston's results, like somewhat similar results obtained in European experiments, have no practical application, since the cost of raising the carbon dioxide content of the atmosphere under ordinary field conditions is much greater than the increased yields thus obtainable would justify.

QUACK GRASS, hated in this country as a noxious weed, has been hybridized with wheat by a Russian plant breeder, Dr. H. B. Tzitsin, of the Tass Agency in Washington. The new grain grows perennially, like its quack-grass parent. This would presumably give it the double advantage of not having to be sown every year, and of covering and binding the soil against erosion with a continuous mat of roots. Small-scale experiments with the hybrid grain indicate that it will yield more flour, bushel for bushel, than "straight" wheat. Bread baked from the hybrid grain flour is said to be of good quality and flavor. Another hybrid wheat combines four wheat varieties in its pedigree, and is stated to be a phenomenally heavy yielder, one stalk producing as many as 400 grains. Still another hybrid wheat has been evolved for growing in the short-summered North; its grain can be matured in as little as 67 days.

BACTERIA that live in nodules on the roots of plants of the pea family and capture nitrogen from the air seem to be preyed upon by a bacteriophage, or group of bacteriophages, of their own. H. Katznelson, of the State College of Washington, tried producing bacteriophages from several different kinds of legume root nodules. Several of his plants, including clover, alfalfa and Austrian lentil, did not do very well and yielded nothing. But a good strong "phage" was obtained from the nodules of vetch plants. Thinned out in water to one billionth of full strength, it could still dissolve the bacteria from which it had been derived. Bacteriophages are a strange group of invisible germ-dissolvers that may be living organisms and may be merely complex "almost-alive" chemical compounds. First discovered some years ago by the Canadian bacteriologist D'Herelle, they are still a great riddle to biologists. Mr. Katznelson's studies on this new type of bacteriophage were reported before the annual meeting of the scientific honor society Phi Sigma.

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SCIENCE NEWS

Science Service, Washington, D. C.

A RADIATION RECEIVER

A SIMPLE signaling device, a possible mechanism for detecting the presence of enemy ships off a fog-bound coast and a highly sensitive apparatus for use in atomic research are among the potentialities of a new receiver of radiation invented by Dr. Hammond Vinton Hayes, of Boston, who was formerly chief engineer of the American Telephone and Telegraph Company.

Dr. Hayes, made cautious by a lifetime of experimental research, makes none of these claims for his new invention with the exception of the possibility of the signaling. But the implications of the discovery are clear. Dr. Hayes goes back to a phenomenon first noted by the inventor of the telephone, Professor Alexander Graham Bell. Before the meeting of the American Association for the Advancement of Science in 1880, Professor Bell told how incident radiation sets up compression waves in the air.

Using this fifty-six-year-old knowledge, Dr. Hayes has built a receiver of invisible heat rays which appears to be much more sensitive than highly delicate thermocouples. It can be used by almost any one, as contrasted with the specialized technique required to perform experiments with thermocouples. It looks like an oversized tomato-can in its physical appearance. The receiver's opening is placed at the focus of a concave mirror which collects the radiation energy and reflects it on the receiver. From the back end of the receiver runs a snake-like, electrically shielded cable connected to a radio-type amplifier. The amplified current can be read on a milliammeter.

The rugged receiver operates by having the incident radiation produce compression waves in air within the apparatus. These waves move a thin disk which is part of the electrical circuit. The disk movement changes the electrical capacity of the circuit and thus varies the amount of current flowing in it. After amplification this minute change of current actuates the measuring meter. Facing the ray-gathering mirror is the window end of the receiver, made of rock salt or other material capable of transmitting infra-red rays. The radiation, passing through this window, enters a small chamber containing a carbonized material which Dr. Hayes—for want of a better term—calls “fluff.” Fluff is made by treating a pappus of a flower so that it yields a light, porous black substance that resembles soot.

Trapped by this porous material, the rays cause the fluff to liberate gas and set up compressional waves in the chamber. The waves move a thin aluminum diaphragm which is part of a standard telephone receiver. And the diaphragm's slight movement varies the capacity of the circuit as already mentioned.

Reporting his invention in the current issue of the *Review of Scientific Instruments*, Dr. Hayes says: “The receiver is more sensitive than a photoelectric cell for waves of radiation longer than the visible (region of the spectrum) and is not affected by background light or

heat, except when the background change is rapid. Moreover, it is insensitive to background noise.” For war-time signaling, it can be realized, such freedom from intense sounds in the background is a highly desirable attribute. For use in signaling the method might well be to set up a source of invisible heat rays such as an electric heater which need not even be glowing at its ordinary cherry red temperature. Rays from this source would be focused by a concave mirror and transmitted as a narrow beam to the receiving equipment. Interruption of this invisible beam with the hand or metal shield could be used to send messages in code. Movements in the recording electrical meter follow the on-and-off shutter motions. “It is of interest to note,” concludes Dr. Hayes in his report of the invention, “that the new receiver responds affectively when a body colder than the ambient temperature is substituted for the radiation source.”

COTTON MOWN LIKE HAY AND CHEMICALLY DIGESTED

AT the meeting in Detroit, on May 12, of the Second Dearborn Conference of Agriculture, Industry and Science, Dr. Frank K. Cameron, of the University of North Carolina, put forth a proposal to grow the cotton thick in the field, forcing the largest possible number of bolls to maturity at the same time, and then cut and dry the whole business, as prosaically as so much hay.

These whole dried cotton plants are to be ground down to a powder. This mass will then be put through a double chemical treatment. The first step will extract the oil, the second will digest both the cotton and the cellulose of the stalks into alpha cellulose, basic material in the manufacture of rayon and other modern products of chemical industry.

Dr. Cameron has been carrying on fairly large-scale experiments for several years and is anxious to see his method tested out in other cotton-growing sections. He is convinced that for his own part of the South, where cotton was first grown in this country, that it is the only possible agricultural and economic salvation. The land there is too hilly for the use of tractors, cotton-picking machines and other types of “cotton field artillery” that have come into action on the flatter terrain of the western Gulf States.

OILS FROM THE ORIENT

AT the meeting at Dearborn an afternoon was devoted to discussion of three Oriental oils and what they can do.

One of them is the now familiar soybean. Once known to city dwellers only as the source of the dark, salty sauce provided in hair-tonic bottles on chop-suey restaurant tables, soybeans have in just about a generation reached the position of a major American crop. Unlike most other crops, they can be grown with profit in practically all parts of the country, and have a wide range of uses, from stock feed to paint.

Less familiar, and as yet little cultivated in this country, is perilla oil, the product of seeds of several related species of Japanese and Chinese plants. Dr. H. A. Gardner, of Washington, D. C., told of methods of cultivation of the plant and of its advantages in paint and varnish manufacture. Perilla oil is what is known as a "drying oil"; that is, it absorbs oxygen from the air and rapidly forms a tough, wear- and weather-resisting coat. It is not used "straight" in paints, but added to slower-drying oils like soybean oil. It is an annual, like wheat or potatoes, and can be sown in fields and harvested by machinery.

The South's new oil plant from the Orient, the tung oil tree, was described and shown in motion pictures by one of the largest of American tung oil growers, Lamont Rowlands, of Picayune, Miss. Mr. Rowlands journeyed to China to get seeds of the tree and information about Chinese methods of extracting the oil.

The seeds he planted, for trees that are now growing; but the information about Chinese tung-oil technique served mainly as suggestions how not to do it. Chinese gather seeds from the wild tung trees only; they never cultivate groves. Their methods of extraction are of the crudest and most primitive, yielding oil filled with dirt and as dark as molasses. Improved American methods produce a much superior honey-clear oil.

There is a large demand for tung oil in this country, by linoleum manufacturers as well as paint makers. The American yield, however, does not yet supply as much as two per cent. of the domestic market.

ALLERGIC DISEASES

THE prevailing idea that allergic diseases such as hay fever, asthma, hives and eczema are inherited was refuted by Dr. Bret Ratner, clinical professor of children's diseases, New York University College of Medicine, at the meeting in Kansas City of the Association for the Study of Allergy.

Dr. Ratner concluded from investigations covering a period of fifteen years that susceptibility to these diseases is not transmitted through the germ plasm, or the genes which are the carriers of hereditary traits. The allergic diseases are acquired by the individual under certain circumstances from the inhalation of pollens, animal or vegetable dusts, or contact with them, or from the ingestion of foods.

Dr. Ratner studied 250 allergic children and 315 normal children and their respective families. Allergy was found about as often in the families of allergic children as in the families of the normal children. Only rarely, Dr. Ratner found, is there a so-called allergic family in which a large proportion of the members suffer from hay fever, asthma, hives or other allergic disorders.

The development of allergy is to a large extent a matter of chance. It depends on the amount of protein to which a person is exposed, the state of permeability of the mucous membranes of nose, breathing and digestive tracts which ordinarily act as a barrier, the ability of the body to rid itself of invading protein substances, and the intervals at which such exposures occur.

This idea of how allergy develops is borne out by re-

search in which Dr. Ratner and his co-workers actually produced asthma in the guinea-pig. They also showed that a child may become sensitized during the period before birth.

The hope held out by the studies, Dr. Ratner indicated, is that since susceptibility to hay fever and other allergies is not inherited through the germ plasm, proper preventive measures can be instituted to control and to a large extent eradicate this common ailment, which is present in every tenth person.

Allergy or sensitivity to certain foods apparently is one cause of a serious and puzzling blood disease known as thrombocytopenic purpura, Drs. T. L. Squier and F. W. Madison, of Milwaukee, reported at the same meeting. Patients suffering from this condition bleed easily, and show black and blue spots of hemorrhage on very slight bruising. The condition is something like hemophilia, but it is not confined to males. Some patients get the disease from certain drugs to which they are peculiarly sensitive. Among such drugs are some of the sedatives and headache remedies and even quinine. In the cases reported by Drs. Squier and Madison sensitivity to certain foods was the cause of the disease.

One little girl was found sensitive to strawberries, wheat, potatoes, coca, beets, walnuts and a number of fruits. She had been in bed for a year, but within one month after the offending foods had been discovered and omitted from her diet, she was able to be out of bed and the purple spots on her skin, from hemorrhage under the skin, had almost entirely disappeared. Food allergy, Dr. Squier emphasized, is only one of many possible causes of this serious blood disease, but he urged doctors to look for this cause in their purpura patients, because in such patients there is a much more hopeful outlook than in some of the cases due to still unknown factors.

Patients who have food allergies do not always dislike the foods to which they are sensitive. Sometimes the very food that causes trouble is one which the patient is particularly fond of. Drs. Warren T. Vaughan, of Richmond, Va., and David M. Pipes, of Shreveport, La., investigated this matter in a large series of patients suffering from major and minor food allergies. About one patient out of five, they found, disliked the foods to which he was sensitive. The only exception to this is in the case of patients who have severe stomach upsets after eating the foods to which they are allergic. These patients generally dislike such foods.

Food allergy may be the cause of unexplained fever that persists in some patients for no apparent cause, according to Dr. L. P. Gay, of St. Louis. He told of one patient, for example, who had been told she had tuberculosis and who spent eight years in bed in a sanatorium. Studies of her blood, following the new test devised by Dr. Vaughan, showed that she was allergic. When the foods had been identified and eliminated from her diet, she became perfectly well and was able to return to work.

THE ELECTROGRAMS OF IDENTICAL TWINS

IDENTICAL twins not only have similar features, coloring and size, they also have identical patterns of brain

activity. This has been discovered by study of brain electrograms, the so-called brain waves which give scientists information about brain activity much as the electrocardiogram gives information about heart activity. The study and its far-reaching implications were presented by Dr. Hallowell Davis and Dr. Pauline A. Davis, of the Harvard Medical School at the Kansas City meeting of the American Medical Association.

Because they found identical patterns of brain activity in the brain electrograms from eighteen sets of identical twins, it appears that the similarities are not due to chance. The patterns apparently follow a biological law and may be an inborn characteristic.

The studies open up possibilities of learning much about inborn patterns of nervous and mental activity. As the authors express it, "Here is a key, fashioned by physiology out of radio. Has neurology a lock which the key can open?"

A characteristic brain electrogram for epilepsy was reported at the same session by Drs. F. A. Gibbs, William G. Lennox and Erna L. Gibbs, also of the Harvard Medical School. These investigators have found that the frontal lobe of the brain is most concerned in epilepsy and they predict that it is only a matter of time until the exact spot in the brain where epileptic seizures start will be found.

A new vitamin D with rickets-preventing power has been obtained from plants, Dr. Charles E. Bills, of Evansville, Ind., reported at a special session on vitamins. This vitamin D was obtained by irradiating a provitamin from sitosterol, the substance in plants which corresponds to cholesterol in animals. Hitherto vitamin D has been obtained from irradiation of cholesterol and ergosterol of animals, particularly fish. Dr. Bills stated that there are now eight forms of vitamin D. Some are more active rickets-preventives in human children, while others are more effective for chickens.

ITEMS

WORD received at Washington by the U. S. National Park Service indicates that Mount Lassen, America's one "live" volcano, continues to show signs of activity. During the first ten days after the new steam jets began to spurt from its slopes, 124 distinct earth tremors have been felt, and have recorded themselves on the seismographs maintained at headquarters in Mount Lassen National Park.

THE death-rate is higher for 1936 in all but 17 of 130 major cities of the nation than it was in 1935, according to figures released by the Bureau of Census of the Department of Commerce. The comparison period is the first 18 weeks of each year. Deaths from motor vehicle accidents are appreciably less for the 18-week period than they were last year, however. The figures for 1935 are 2,949 deaths in vehicle accidents while for the same period in 1936 only 2,503 motor vehicle deaths have occurred.

THE fire loss of the nation for 1935 was \$259,000,000, according to preliminary estimates made at the meeting in Atlantic City of the National Fire Protection Asso-

ciation. This is the smallest loss by fire since 1916 and \$16,500,000 less than in 1934. Since September, 1935, the fire losses per month have gradually been increased, bearing out previous predictions that increased business activity would bring fire loss. Encouraging, said the NFPA report, was the fact that while business activity has reached 80 per cent. of 1927-29 levels, fire losses are only about at 60 per cent.

THE first new comet to be discovered this year, visible through small telescopes as it rides slowly through the northern heavens near the pole, has been sighted by Leslie C. Peltier, of Delphos, Ohio, thirty-two-year-old garage employee who has become one of the world's amateur astronomers. The comet, the fifth to be discovered by Peltier, has been photographed at the Harvard Observatory, where Dr. Harlow Shapley, director, announced the find. The body has a tail about one degree long and is in the northern constellation Cepheus. Its position is given by Dr. Shapley as declination plus 73 degrees, right ascension 23 hours 45 minutes. The comet is of the ninth magnitude at present and Dr. Shapley expects it to remain that bright for some time. It is moving south and east. The discovery has also been confirmed, Dr. Shapley said, by observations communicated to him by Dr. George van Biesbroeck, of the Yerkes Observatory.

LIKE many truck farmers, Charles J. Gault, near Magnolia, Ark., has worried about pre-season competition from the warmer Rio Grande area. Now his problem is solved by the use of an electrical hotbed capable of growing 1,000,000 plants and having a total area of one tenth of an acre. Eight thousand feet of soil-heating cable are used in eight covered beds. Temperatures of from 50 to 60 degrees Fahrenheit can be maintained in the ground when outside temperatures are as low as 15 or 20 degrees. The air temperature of the beds ranged from 40 to 60 degrees. First planting in the beds, it is reported in the forthcoming issue of *The Electrical World*, occurred on January 27. Capacity of the heating cable is 50 kilowatts of electrical power. The heat released is 6,500 b.t.u. per hour for each of the eight sections. Installation cost was \$3,000.

Two stone knives, hidden deep, have come to light and are pronounced evidence that man roamed forests of Oregon over 17,000 years ago. Estimate of the age when the knives were made by human hands and used in the American wilderness has been reached by Dr. L. S. Cressman, professor of anthropology at the University of Oregon. Dr. Cressman made excavations at the spot where the knives were found by U. S. Reclamation Bureau survey workers. No additional objects have been found, he reports, but the examination satisfies him that the stone knives were not buried from above, but belonged to the stratum of earth which came in time to be covered by two feet of pumice and three feet of yellow soil and gravel. "The knives are made of obsidian which has become highly devitrified. They show a primitive quality of workmanship roughly approximating late Mousterian or early Aurignacian."

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SCIENCE NEWS

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TELEPHONE'S DEVELOPMENT AS THE
RESULT OF ORGANIZED RESEARCH

DR. FRANK B. JEWETT, president of the Bell Telephone Laboratories, speaking before the Franklin Institute, Philadelphia, pointed out that without highly organized industrial research the modern telephone would never have come to its present stage of perfection.

Dr. Jewett traced the research development of the telephone and its associated arts of the radio and sound motion pictures in an address following the presentation to him of the 1936 Franklin Institute Gold Medal. From 1880 to 1900 the telephone grew in industrial stature because its problems were of such a nature—looking back they seem extremely elementary—that they could be solved by uncoordinated individuals working, each for himself, in separate laboratories and by borrowing proved knowledge from the older telegraphic field. Coordinated, organized research came into being when the increased demands for inter-community phone service occurred. Problems of distance transmission arose, unsolved difficulties with interlocking switching facilities sprang up and the central offices had to be redesigned to meet increased volumes of traffic. Ingenuity for a short while helped, but it soon became apparent that the solutions obtained were becoming increasingly costly. The final solution came by a mass attack on the problems from widely different fronts, utilizing knowledge in widely scattered fields. At one stage it was even necessary to go over into physiology and anatomy to learn more about the process of hearing itself.

In accepting the medal, Dr. Jewett indicated that it should be regarded less as a personal honor to him than as a trust for his younger colleagues and associates who have made telephone advances possible by their research. His own job had been to direct these men so that they could develop the maximum of their creative scientific ability. He said: "It is easy for a superior to take or appear to take credit for accomplishments of his younger associates. What is hard is regularly to appear in the rôle of a critic—an apparent reactionary in the ranks of ardent enthusiasts. As I look back over my thirty years of work in this field of applied science, I have a feeling that I may have contributed as much toward advancing the art of electrical communication by what I have prevented being done as in what I have encouraged."

NEW COMET TO BECOME VISIBLE IN JULY

THE new Peltier comet, discovered recently by an amateur astronomer, will in all probability be the brightest since the last appearance of Halley's famous comet in 1910. It will be easily visible to the naked eye during the latter part of July when it will flash into sight just before dawn each morning. It will be the first comet visible without telescopes since 1927. The new comet was found recently near the North Star by Leslie C. Peltier, garage employee of Delphos, Ohio, who has become one of the world's outstanding amateur astronomers.

According to calculations made at the Harvard College Observatory, the comet is now approximately 120,000,000 miles from the earth, but since its discovery its brightness has increased from the ninth to the eighth magnitude. When first sighted it was visible only through telescopes, although low-powered ones picked it up easily, but by the end of July the comet is expected to be brighter than the sixth magnitude and within 20,000,000 miles of the earth. At that time, the Harvard computations indicate, it will begin to recede, slowly fading from sight.

Drs. Fred L. Whipple and Leland E. Cunningham, of the Harvard Observatory staff, who made the calculations from photographs taken with the observatory's cameras, state that any one wishing to see the unusual astronomical display had better do so this year, for the comet is not expected to return to the vicinity of the earth for several centuries. It is now located in the northern constellation Cepheus.

Although the comet is moving in a south and east direction, it is moving so slowly that it is expected to be in substantially the same position two months from now when it becomes visible to the naked eye. Its course has been tentatively determined as in the shape of an open parabola about the sun. Apparently it never approaches that body any closer than the earth does, that is, about 93,000,000 miles.

FORCES ACTING ON AN AIRSHIP DURING
LANDING AND TAKE-OFF

News pictures of the second landing of the *Hindenburg* at Lakehurst, N. J., show straining ground crews tugging frantically at the throw lines of the giant airship. Three times the aircraft missed the mooring mast. Water ballast showered soldiers, reporters and photographers below to prevent a ground bump and hydrogen had to be valved to lower the craft again to the mooring mast level. "Docking" the airship was real work in both the technical and labor sense.

On the same day the *Hindenburg* landed, more than 300 aeronautical scientific men and engineers were gathered at the laboratories of the National Advisory Committee for Aeronautics at Langley Field, Virginia, to inspect the latest developments in research which is keeping the United States in the forefront of military and civil aviation. Strikingly illustrative of the importance of the research of the committee was the report on the very same problem which confronted the *Hindenburg* in its difficult Lakehurst landing.

During last year, the great wind tunnel where the Army and Navy's combat planes are tested, have been turned, for a time, to the study of problems in landing giant airships. A large platform, big as many a ballroom floor, was built in the experimental chamber of the giant tunnel to simulate the ground. An airstream flowed across the floor as would the wind on a landing or take-off. And a twenty-foot long model of the ill-fated *S.S. Macon* went through experimental take-offs and land-

ings for the members of the committee. Only in the enormous wind tunnel at Langley Field could such a large model be used for experiment.

Through concealed and delicate instruments the forces acting on the *Macon* model were discovered as the airship replica was turned—or yawed as the aviation scientists call it—at varying degrees with the airstream. The results were astounding. For an airship the size of the *Macon* (and by inference the *Hindenburg* also) the forces in a mere twenty-mile-an-hour wind were 25,000 pounds in vertical lift and the lateral forces on the craft could amount to 65,000 pounds! Thus on landing it is not inconceivable that a ten-ton truck could be lifted off the ground by the effects of the airship's yaw and the wind. No wonder then that the ground crews strain frantically on their lines in efforts to ground the craft.

The new studies will be highly desirable because they bring a new conception of the magnitude of the forces acting. Ground crews can be better trained for their difficult and all important task. In many cases their number will be augmented to meet emergency conditions.

THE COAST LINE OF LONG ISLAND

THE entire ocean front of Long Island—120 miles long—has become an out-of-door laboratory for the study of beach erosion.

The U. S. Beach Erosion Board, a division of the Corps of Engineering of the U. S. Army, and the Long Island State Park Commission are making the cooperative survey which will study, on the broadest possible scale, the nature and cause of beach erosion. Previously erosion and sand movement studies have been designed to aid or solve some specific situation.

Four times each year, and as soon as possible after severe storms, underwater profiles are made by the field staff. These profiles are graphs made from depth data along lines that run from the beach out to sea for distances 4,000 to 5,000 miles off-shore. Taking successive studies it is possible to see how the ocean bottom is changing with time and is altered by known storm conditions. Water samples and sand samples form another part of the project. The former are samples from which quantity of sand in suspension can be determined and the latter consists of sand composing the ocean bed.

An auxiliary study consists of current readings showing the speed and direction of currents along shore which can pile up sand in one place and remove it from another. Subsurface floats are used where the water is over two feet deep. For depths shallower than two feet surface floats and colored liquids are dropped into the water and their movement watched and measured.

Aerial photographs and borings of the bottom to determine its basic nature are also part of the program, according to *Shore and Beach*, the quarterly journal of the American Shore and Beach Preservation Association.

TEST FOR BLOOD PRESSURE OPERATION

A TEST which enables the surgeon to predict the outcome of operations for relief of high blood pressure before he starts the operation was reported by Dr. Edgar

V. Allen, of the Mayo Clinic, Rochester, Minn., at the meeting of the American Heart Association. Dr. Allen developed the test in collaboration with Drs. J. S. Lundy and A. W. Adson.

The test is used to determine which patients will be helped by this modern method of relieving very high blood pressure. Patients who will not be helped as shown by the test are thus spared what would be, in their cases, a useless operation.

The test consists in injecting into a vein an anesthetic, sodium pentothal, which puts the patient to sleep. This anesthetic, which is related to amytal, causes the patient's blood vessels to dilate temporarily, thus lowering the blood pressure. The operation produces the same effect but it is a permanent one. If the anesthetic does not cause the drop in blood pressure, the surgeon knows the operation would not be successful either.

The patient is under the anesthetic for about 15 minutes in the simple test and is able to be up and around within an hour. The operation itself consists in cutting a set of involuntary nerves which control dilation and contraction of blood vessels within the abdomen. A similar operation has been devised for Raynaud's disease, the condition in which impaired circulation in the extremities causes the fingers and toes to turn white, blue, or red on exposure to cold or when the patient gets excited. An improved technique for performing this operation was reported by Dr. James C. White, of Boston, and consists of cutting those involuntary nerves which control the size of the blood vessels of the extremities. As first devised, the operation cured the condition as far as the toes were concerned, but Dr. White noticed that a few months after operation the hands continued to turn color when the patient became excited. In his opinion, this is because the nerves were not cut in the right place, so he devised a new operation for relieving the condition in the hands which apparently gives the same results as the original operation does for the feet.

PREVENTION OF A MEASLES EPIDEMIC

A WHOLE county in rural Michigan has escaped a severe epidemic of measles by a united campaign of measles prevention and modification undertaken by the county medical society. The campaign was begun early this year in the face of a predicted epidemic of unusual proportions, not only lowered the county death-rate from the disease, but showed how effectively a concerted attack against disease can be carried out in a country community.

Dr. E. G. McGavran, secretary of the county medical society, Hillsdale, Mich., describes the county-wide use of a recent weapon in fighting measles, immune globulin, in the forthcoming issue of the *Journal of the American Medical Association*.

This practical agent of preventing or lessening the severity of measles, successfully used by Dr. Charles McKhann, of Harvard, in the Children's Hospital, Boston, was imported from the Massachusetts State Biological Laboratories by the county medical society. Individual physicians, conservative and critical of results, were given

SCHOOL AND SOCIETY

EDITED BY J. McKEEN CATTELL

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the "serum" free of charge. In return they promised to keep a careful record of their cases and turn these back to the county society for analysis and conclusions.

To get the public behind the measles prevention program, the medical society sought newspaper publicity, made speeches before associations of parents and teachers and talked to the children about measles and its dangers.

Only four instances of the failure of the immune globulin when administered intramuscularly were reported. Dr. McGavran states that in these cases the "serum" was given nine days or more after exposure to the disease. If these four cases were thrown out because of incorrect time of administration and incorrect amount of immune globulin used, 100 per cent. success could be reported in the seventy-three cases remaining. When the new treatment was given by mouth rather than intramuscularly, the percentage of success was only slightly lower.

ITEMS

AN earthquake officially described as a "very strong shock," occurred at the Solomon Islands in the South Pacific Ocean on May 19 at 10:05 P. M. Eastern Standard Time. From earthquake data assembled by Science Service, seismologists of the U. S. Coast and Geodetic Survey located the quake's epicenter at about 8.5 degrees south latitude, 160 degrees east longitude.

THE great research laboratories of the National Advisory Committee for Aeronautics were thrown open to visitors as the two-day session on aircraft engineering research began on May 20. The giant wind tunnel, which will hold a full-sized combat pursuit plane of the nation's air forces, was again the center of interest as government officials and the executives and engineers of the aircraft industries arrived by boat from Washington. A similar conference was also held on May 22 for the personnel of the government agencies using aircraft, representatives of engineering societies and the faculties of professional schools.

THE world's largest high-speed wind tunnel, which can create an air flow at a top speed of 700 miles an hour, was the key demonstration of the "open house" staged at the research laboratories of the National Advisory Committee for Aeronautics. The super-high air speeds in the eight-foot diameter tunnel permit the testing of large-scale airplane models at speeds greater than either the world's speed record or the maximum speed attained when the most modern airplanes are driven nose first toward the earth in a power drive. The staggering air speeds are obtained by a sixteen-foot propeller powered by an 8,000 horsepower motor housed in a separate building. The powerful twist imparted to the air by the propeller is removed by a series of vanes.

A TWENTY-FOOT diameter robot balloon made of cellophane has been launched on the riding field of Swarthmore College. The balloon, inflated with hydrogen, was sent into the stratosphere by Dr. Thomas Johnson, assistant director of the Bartol Research Foundation of the Franklin Institute. Its ultimate function will be to study the nature of cosmic rays without the necessity of

sending up giant balloons carrying scientific men. Automatic radio transmitters send back to earth the information obtained by scientific instruments. In this initial flight Dr. Johnson did not send up cosmic ray measuring equipment, but merely recorded temperature and pressure in the upper air. After a study of the flight, plans will be made for further research and refinements of the apparatus.

DENMARK is building a new *Dana*, to replace the old oceanographic research ship of the same name, sunk about a year ago in a collision with a German trawler. Oceanographic research is so important for the fishing industry that funds were immediately granted by the Ministry of Finance for a new research ship to an amount of about 900,000 crowns, or about \$200,000. The new *Dana* will have a length of 147 feet, a beam of 26 feet, and a depth of 13 feet. A 700-horsepower Diesel engine will give the vessel an average speed of from 11 to 12 knots. Thanks to generous offers from Scotland, Holland and England, putting their expedition ships at the disposition of the Danish research authorities until the completion of the new *Dana*, there will be no break in the continuity of the fishery research, as a single year's break in this work might have disastrous results for the fishing industry.

A HUNT for the most ancient human beings in America will be conducted this summer, by an expedition to the northwestern doorstep of the continent, where the first immigrants presumably entered. Led by Henry B. Collins, Jr., of the Smithsonian Institution, the expedition sponsored jointly by the National Geographic Society and the Smithsonian Institution, is *en route* to the westernmost point of North America, Cape Prince of Wales, Alaska. This is the most likely place where ancient men would have crossed from Asia, only 55 miles away *via* Bering Strait. Previous Alaskan expeditions by Mr. Collins and other archeologists have pushed Eskimo prehistory back to about 1000 B. C. The expedition has hope of finding skeletal remains or discarded weapons of still earlier people who must have passed this "port of entry" region at the dawn of American habitation.

A MOTION picture camera so small and compact that it can be pushed into the larynx, to take films of the vocal cords in action, has been invented by two Viennese investigators, Dr. Kamillo Wiethe, a physician, and Dr. Franz Gerhard Back, an engineer. It is expected to be useful in at least three ways: to study the mechanics of the voice, particularly in famous singers; to investigate the physiology of the production of the various vowel sounds, and as an aid in the diagnosis of throat diseases, particularly those with a nervous involvement. The new camera is an addition to an already existing series of miniature photographic apparatus designed for obtaining pictures of various internal cavities. One camera, for taking pictures of the inside of the stomach in the diagnosis of gastric ulcer, cancer and other ailments, is swallowed by the patient. It carries its own tiny light bulb with it. Once the exposure is made, the surgeon pulls the camera up again and develops his film.

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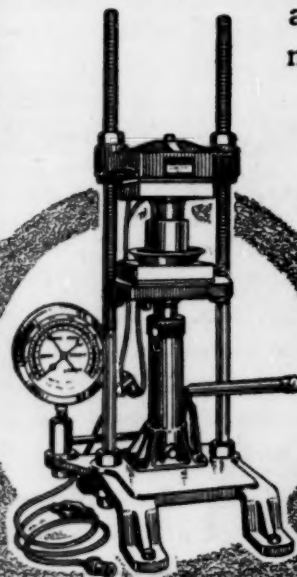
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MODELS OF MOLECULES

A WATCH designer, in order to facilitate his work, may construct a model several times as large as the finished time-piece will be.

How convenient it would be for the organic chemist if he, likewise, could enlarge the molecules with which he deals to a size of several inches. Instead, then, of vainly attempting for months to prepare a certain compound, he could have seen at the outset that the method he was using could not possibly lead to the desired result.

The organic chemist is always anxious to know just how closely atoms or groups of atoms, appearing in the molecules of a compound, approach each other in space. With this knowledge he could foresee whether or not certain phenomena would take place.

To represent organic molecules correctly, models should be composed of spheres made to the scale of the atoms with a properly chosen magnification. Moreover, the spheres should not be separated by rods as are those in the old-type models.

This has been fully realized by Dr. Robert E. Steiger, of Swarthmore College. His "Organospheres" are 172,410,000 times the actual size of the non-metallic atoms one is most likely to find in organic substances. Made of solid aluminum, they can be connected to each other, at specific points ("valence points") on their surfaces, by means of pins which are no longer visible once the connection has been effected.

To speed up construction of the desired models, complete sets of organospheres contain assemblages of two or more spheres corresponding to the groups of atoms most frequently occurring in organic compounds.

George A. Bourdelais, of the engineering division of Swarthmore College, deserves great credit for having successfully solved the serious technical difficulties encountered in the making of the organospheres, thus having provided organic chemists and teachers with an effective tool for research and demonstration work.

But how, one may ask, can it be known how large the atoms are? This is accomplished with x-rays by examining the reflected pattern produced when a beam of x-rays is shot into a crystal of the substance in question. In addition, the models themselves may furnish considerable information as to the sizes of real atoms. For, if certain molecules are known to exist and to behave in a certain way, the models may show that this behavior is only possible when the sizes of some of the atoms lie within narrow limits.

In this way, Dr. Steiger was able to assign to the hydrogen atom attached to an aromatic ring a radius of 0.00000000173 inches (0.44 Angstrom units). Several months later, Dr. P. L. F. Jones, of England, obtained exactly the same value by a more direct method.

Dr. Steiger is now engaged in research to prove that several rather simple compounds must be mixtures of optically active modifications because they are not at all symmetrical in structure as is generally believed.

W. E. DANFORTH

DEVELOPMENT OF AIRCRAFT ENGINES

By 1940 aircraft engines will develop at least 1,600 horsepower in a single engine unit, according to a prediction made by the British aeronautical engineer, H. Wood, of Rolls-Royce, Ltd., before the meeting of the Society of Automotive Engineers, meeting at White Sulphur Springs, W. Va. By special invitation of the society, Mr. Wood came from England to present recent advances in the art of cooling airplane engines with liquids—either water or the newer glycerine compounds.

Wherever modern airplanes are flown, cooling is a major problem, for in many cases airplane engines already overheat if operated on the ground for any length of time. Only at the high velocities of cruising flight is sufficient air drawn over the engine to give proper cooling. Liquid cooling used in the best English airplanes is in sharp contrast to the common American practice of using air-cooled engines. The engine of high horsepower in the future, Mr. Wood intimated, will probably consist of many small cylinders to take advantage of the relative increased cooling surface thus attained. British aircraft engines—at least the major part controlled by Rolls-Royce—will continue to be liquid cooled in the future. His invitation to speak, he said, had been accepted in the spirit of a friendly challenge.

It has only been since the adoption by air-cooled engine manufacturers of the special engine cowlings devised by the U. S. Government's National Advisory Committee for Aeronautics that British airplane engine producers had had to worry greatly about the development of liquid-cooled engines. Previously the small front area of "in-line" liquid-cooled engines gave a smaller air drag than the much larger radial air-cooled engines. With the cowlings, however, air drag has become essentially comparable for the two contrasting engine types. Thus the liquid cooling advocates have had to revise their concepts.

Progress in English liquid-cooled engines, Mr. Wood admitted, has not been as spectacular as the American developments in air-cooled aircraft engines. The rapid development of civil aviation in America has been instrumental in this fast development. By contrast, he pointed out, civil aviation in England is comparatively small and most engines have been built for the British Air Ministry for military purposes. The Air Ministry has maintained a balance between air-cooled and liquid-cooled engines resulting in the keeping of technical advantage to both.

TESTING LIGHTING SYSTEMS BEFORE INSTALLATION

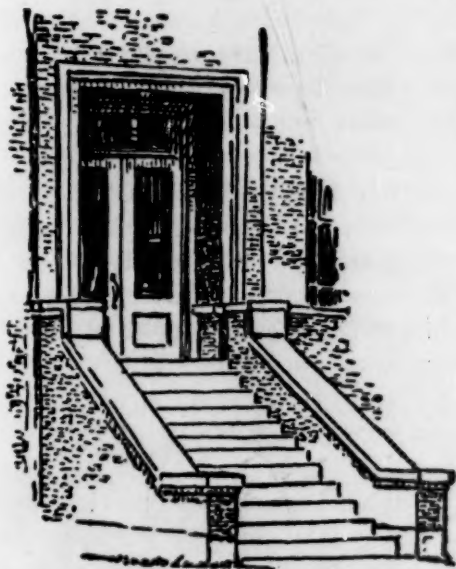
A MODEL room for the accurate testing of lighting adequacy under any given conditions is now available to architects or builders in the illumination laboratory of the University of Michigan. This apparatus, the only one of its kind in the world, according to Professor H. H. Higbie, department of electrical engineering, will make it possible for architects to determine in advance

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CHEMICAL methods of analysis as compared with animal assays for the determination of vitamin C have the advantage of greater speed and convenience without loss of accuracy. The method employed by Bessey and King, using 2,6-dichlorophenol-indophenol, has proved very popular because of the ease of manipulation. Improved accuracy in this test is now made possible with the purified indicator recently perfected.

This purified indicator, listed in *Eastman Organic Chemicals*, List No. 27, as P 3463 Sodium 2,6-Dichlorobenzenoneindophenol, is supplied at the same price that prevailed for the older reagent—1 g., \$1.00. It is available for immediate shipment. Eastman Kodak Company, *Chemical Sales Division*, Rochester, N. Y.

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the exact performance of any lighting system which they may design.

By changing the ways in which light is admitted, and by varying the kinds of paint on the ceiling, floor and walls of the model room, any lighting conditions may be reproduced to solve specific problems of illumination. The accuracy of the apparatus is insured by a complete check before each test is made. Numerous tests in full-size rooms have verified the applicability of the data obtained with this device.

A photo-electric cell, mounted on a carriage, moves back and forth, so that an accurate survey of the whole room may be made. The current generated in this "electric eye" is amplified, then recorded by means of an oscillograph. A beam of light, developed in the oscillograph, falls on a moving strip of photographic paper, thus making a graphic record of the trip of the "electric eye" about the room.

If it were not for reflections, this complicated apparatus would be unnecessary, since illumination could be calculated by mathematical means. The troublesome reflection difficulty, however, is solved by covering the "electric eye" with a diffusing glass, which catches light from all angles and transmits it to the photo-electric cell.

Most of the present tests are conducted with the luminous panel type of lighting, which is now coming into vogue. Permitting almost unlimited variations, as well as efficient illumination, it may readily be incorporated into the decorative scheme.

GROWTH OF HUMAN MARROW IN THE LABORATORY

HUMAN bone marrow has been grown in the laboratory for the first time in quantities sufficient to permit studies of the blood and metabolism. The complicated apparatus for growing this important human tissue outside the body is described by Dr. Edwin E. Osgood and Alfred N. Muscovitz, of the University of Oregon Medical School, Portland, in the *Journal of the American Medical Association*. The report of their work recalls the fact that it is not quite a year since Dr. Alexis Carrel and Colonel Charles A. Lindbergh reported their experiments at the Rockefeller Institute, New York, in which they devised a glass apparatus for growing living glands outside the body.

The apparatus for growing bone marrow gives promise of solving important problems concerning changes in the blood and bodily tissues. The red marrow of bones produces the red blood cells, so it is likely that the new apparatus may aid in the study of anemia in which there is a breakdown in red blood cell production.

Construction of the marrow-growing apparatus is complicated; the parts are chiefly of glass. Most important of the features is a semi-permeable membrane separating the culture from the main volume of medium. This membrane permits nourishment from the surrounding medium to reach the culture and allows waste products to diffuse out as they accumulate. Because of this equilibrium, analysis of the outflowing medium gives a good

indication of conditions in the culture. Investigation of eighteen distinct problems by means of the new apparatus is under way at the medical school in Portland, and many other problems suitable for investigation await later attention.

Dr. Osgood and Mr. Muscovitz believe that the method appears to offer sufficient promise to justify preliminary publication with the hope that other investigators may aid in realizing as rapidly as possible its full potentialities. A grant from Eli Lilly and Company, Indianapolis, made possible the construction of the apparatus.

POISON IVY

(Copyright, 1936, by Science Service)

POISON IVY just now has the unenviable distinction of being Public Pest No. 1. You can't go out on a picnic yourself, you can't send your children to camp, without the risk of having your household quiet upset for a week by an attack of the blistered, itching, red-skinned affliction known to the medical profession as rhus dermatitis, but to the laity as just plain ornery ivy poisoning.

Hardly a corner of the land escapes. Poison ivy grows all over the United States and Canada east of the Rockies. Its evil twin, poison oak, takes charge of the Pacific Coast region. And in eastern boglands a third member of this criminal fraternity, poison sumac, holds its sway.

Eastern poison ivy and western poison oak look so much alike that it takes an expert to tell them apart. They are either low shrubs on the ground, or vines climbing trees and stone walls by means of thousands of short, clinging aerial roots. Each leaf is divided into three leaflets; whence the ancient doggerel warning, "Leaves three, let it be!" This distinguishes them from the American woodbine or Virginia creeper, which has five leaflets to a leaf: "Five fingers may handle five leaves." Both prefer open, moist woodlands—exactly where you like to picnic or camp.

Poison sumac is found only in the East, and only on the borders of acid bogs—in the same kind of soggy land where grow tamarack trees, skunk cabbage and the purple pitcher-plant. It is more vicious than either poison ivy or poison oak, but attacks fewer people. It looks very much like common sumac, but differs in having drooping clusters of pallid, waxy berries, and a pale gray bark. Moreover, common sumac grows mostly on uplands, never in bogs.

All three of these plants are strictly American products. The first person ever to take notice of poison ivy in print was Captain John Smith. His description of the symptoms is so conservative and accurate that it casts some doubt on his eligibility for membership in the Ananias Club, in which tradition has always voted him a charter membership. Noting that it differed little in appearance from English "yvie," the redoubtable captain went on to state that it "causeth rednesse, itchyng, and finally blysters," but that if let alone the ailment presently went away of itself. Captain John Smith must have had a good tough hide.

Or he may have been one of the fortunate half-immune

people. The three poison weeds affect different persons very differently. Some seem to be totally immune—though this immunity can never be depended on to last indefinitely. And immunity once lost is seldom recovered.

The poison of poison ivy and its kin-criminals is an oily substance related to carbolic acid. The leaves must be contacted to give you a "dose." Stories of ivy poison "caught" from just going near the plant most probably have some unknown or ignored element in them. Either the victim had previously rubbed against poison ivy somewhere else, without noticing it, or had handled some object that in turn had been in contact with poison ivy—garden tools, for example, or a picnic basket. It is even possible for an extremely susceptible person to be poisoned by shaking hands with an immune person who has been recklessly plucking poison-ivy leaves.

Fortunately, most poison ivy victims can get rid of their affliction in relatively short time, and it is even possible to prevent yourself from being poisoned at all. Something over 300 remedies have been proposed for ivy poisoning. Most of them of course are worthless, but there are several that really work. A very good remedy, not as well known as it deserves to be, is a five per cent. solution of potassium permanganate in water. You can mix this up yourself, or get your druggist to do it for you. Puncture all blisters, and swab up their watery contents with absorbent cotton or sterile gauze. Then thoroughly moisten all poisoned skin areas with the solution. It will turn the skin brown, but this can be cleaned up after a time with lemon juice.

A highly successful preventive treatment is a five per cent. solution of ferrous sulphate in a half-and-half mixture of water and alcohol, with a little glycerin added. Wash this solution on all exposed parts of the skin, before going into the woods. Do not rinse or dry the skin; let the solution dry in place. The iron in the compound unites with the poison and renders it insoluble and harmless. This "iron treatment" has been used by thousands of persons, and has given complete protection to all except a very few unlucky extreme-susceptibles.

FRANK THONE

ITEMS

RIVERS and streams of America are being polluted by a third of the nation's population and by reviving industries, despite a quarter century struggle by health and conservation experts to keep water supplies clean and safe. This warning is being carried to President Roosevelt from a conference of governors, senators and technical authorities held in Washington. Abel Wolman, Maryland Health Department chief engineer and water resources specialist, revealed the present extent of the threat to clean, drinkable water. Dr. Thomas Parran, U. S. Public Health Service Surgeon-General, spotted as regions of acute pollution: "Ohio River, the Niagara frontier, Hudson and Connecticut rivers and the upper reaches of the Potomac. Water poisoned by sewage and wastes from factories can be made drinkable by purification treatment, but there is a limit to the pollution that can be counteracted by engineering methods. The limit is

now being exceeded at several points along the Ohio. The conference went on record urging President Roosevelt to sponsor the passage of a Congressional bill allowing the U. S. Public Health Service to tackle the problem of stream pollution.

THE *Journal* of the American Medical Association, official spokesman of the medical profession, says of the federal food and drug bill in the forthcoming issue: "The first bill introduced has been subjected to a sort of plastic surgery which has resulted in a specimen not even resembling the original model and utterly deficient in many particulars. Formulas under this bill are secret and filed with the Department of Agriculture. Violations must be carried from the department into the Federal Trade Commission. The procedure is so long and wearisome and the penalties so inadequate that the forces of quackdom may ravage the sick and ailing and retire with their booty long before the processes of investigation and prosecution catch up with them." The bill is so far from ideal that it had better be scrapped, the *Journal* states, and a new beginning made when a more favorable opportunity offers. Perhaps the best procedure would still be to amend and strengthen the original, thirty-year-old pure food and drug law by taking account of the need for control over advertising, the great development of the cosmetic industry, and the newer social viewpoint which demands adequate protection for the uninformed consumer.

NEED for evolution of a new specialty, that of medical sociology, was pointed out by Dr. R. R. Spencer, U. S. Public Health Service, at the Atlantic City meeting of the National Conference of Social Work. Physicians, social workers and public health nurses would meet in this field which Dr. Spencer termed a "borderland science." They would study the relation of social conditions to health and disease, and work out measures, both medical and social, for improving health. He compared this new specialty with such established ones as radiation-genetics and economic entomology. Dr. Spencer is chief of the newly organized office of public health education in the scientific research division of the U. S. Public Health Service.

BOTANIZING over a gap of a century and a half, on preserved plant specimens that have crossed the ocean twice, is to be the unique task of Paul C. Standley, of the Field Museum Herbarium. Approximately 7,000 plants, collected in Mexico while that country was still a Spanish colony, have lain untouched in the vaults of the Botanical Garden of Madrid, while wars and revolutions swept the earth above them. Through all Spain's turbulent modern history, no adequate examination of these rare specimens has been possible. Now, because Mr. Standley has made a special study of the botany of Mexico and the Middle Americas, the Spanish authorities have entrusted to him the task of identifying and describing the specimens. The main collection will eventually be returned to Madrid, but the Field Museum will be permitted to retain some of the plants.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE CAUSE OF HEADACHE

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"TIDES" in the brain make a headache—the "morning after" kind or otherwise, Dr. Temple Fay, professor of neurology at Temple University Medical School, Philadelphia, told members of the American Neurological Association meeting in Atlantic City on June 1. Headaches, it appears, may be classed relatively as wet ones (high tide) and dry ones (low tide). The headache of the "morning after" is a wet one, though not all wet ones are due to alcoholic indulgence. General over-indulgence in food and fluids brings on this kind.

What makes a headache, reduced to simple terms, is the amount of fluid in and around the brain. Too much or too little of this fluid results in stretching the large blood vessels that supply the brain. The stretching is what hurts. Dr. Fay determined this by stretching the nerves of these blood vessels in the brains of patients undergoing brain operations.

The wet headache—too much fluid in the brain—is most common in the overweight, hydrated person who consumes large quantities of food and fluid and does not eliminate enough fluid. This person should, in general, reduce the amount of liquid consumed to not more than one quart a day.

The headache noted in the common type of underweight, overactive, nervous individual arises when fluid from the body is too rapidly lost from the skin or kidneys and can not be properly retained in the brain cavity. This type of person, with the advice of his physician, should increase his fluid consumption to three or more quarts per day along with extra feedings.

These directions, Dr. Fay pointed out, apply to the true variety of headache, and should not be followed until medical examination has ruled out other conditions which may refer pain to the head. The beneficial use of certain drugs for headaches was ascribed to their effect in regulating the fluid and blood volume relationship in the brain.

The large blood vessels which give a headache when stretched are the only structures in the brain that carry pain fibers. Besides stretching because of too much or too little fluid, irritation of these vessels at other places on their path to and from the brain gives rise to pain felt in the head as a headache. Such irritation may arise in the neck, chest or abdomen, and this explains the headaches that may accompany infections in nose, throat or in diseases of the chest and abdomen.

The discovery of the mechanism of headache reported is based on many years of research by Dr. Fay and other investigators. He also reported a test, called a cephalogram, for determining whether a headache is of the wet or dry variety.

WARM TEMPERATURE AND BLOOD FORMATION

(Copyright, 1936, by Science Service)

DISCOVERY of a hitherto unknown but fundamental relation between temperature and blood formation was announced at the meeting of the American Medical Association. The discovery, which may give physicians new leads to the treatment of infections and blood diseases, was made by a group of Chicago surgeons, Drs. Charles B. Huggins, W. J. Noonan and B. H. Blockson, of the University of Chicago.

The blood factory of the adult body is located in the marrow of certain bones. This factory can not operate at low temperatures, it appears from the experiments reported by Dr. Huggins and associates. No blood is made in the marrow of the bones of the hands, feet and lower parts of the arms and legs because it is too cold there.

No application of the discovery to disease or its treatment was made. The authors of the paper are at present content to have found an answer to the question of why the marrow in some bones is the red, blood-forming variety while the marrow of other bones is yellow and forms no blood.

Certain practical aspects suggest themselves, however. New knowledge about the mechanism of blood formation may well be expected to prove helpful in finding the causes and better methods of treating blood diseases. This discovery also suggests that it may be a good thing when a sick person has fever because when the temperature goes up it may favor production of more blood which the patient needs to fight the infection. Physicians who treat disease by inducing fever, a method being demonstrated at the medical meeting, may come to revise their methods as a result of this latest discovery. Raising the body temperature a slight amount for a week, the discovery suggests, might prove more beneficial than elevating it to a high point for a few hours once or twice a week, as is now the practice.

Discovery of the importance of temperature for blood formation in the bone marrow was made by ingenious experiments which, as Dr. Huggins explained them, seemed so simple that the layman might wonder why no one had thought of them sooner. One reason is that the experiments required the use of modern surgical technique and a modern physical instrument, the thermocouple, which detects small differences in temperature in body tissues. The red, blood-forming marrow in bones changes abruptly to the yellow variety in the extremities; the sharp line between the two, seen in the specially prepared skeletons of small animals which Dr. Huggins exhibited, suggested that the cause must be physical rather than chemical. With thermocouples the temperature of the bones above and below the line of change in marrow

color was measured, and it was found that the bones with yellow marrow were definitely colder.

Proof of the causative relation of temperature to blood formation was obtained by operations in which the tip of an animal's tail was inserted within its abdomen, or the feet of baby rats were dropped into the abdomens of their mothers. Instead of turning yellow, the marrow of these extremities stayed red and continued to form blood when in the new warmer location within the body. The temperature of 96 degrees Fahrenheit, it was found, is required for blood formation by the bone marrow. The marrow of the red, blood-forming variety is found in all bones at birth, but by the time a baby is about a year old the marrow in the extremities has turned yellow.

THE AUDIBILITY OF LANGUAGE

THOSE who would create a universal language should take account of the new science of acoustics. Such is the suggestion of Dr. Vern O. Knudsen, of the University of California.

Apparently little or no attention has been paid to the question whether the words of Esperanto or other artificial languages are readily understandable in spoken form. In view of the vast amount of time wasted in retarded telephone calls and acoustic confusion in poor auditoria, the creator of a language should avoid the use of syllables frequently misunderstood.

Incidentally, English is probably not the best language in this respect. For example, the terminal consonant group "ng," so common in English, is perhaps the worst offender in the alphabet. In the Los Angeles auditorium tests, words ending in -ng were misunderstood more than half the time. In general, words ending in consonants are more likely to be missed than those ending in vowels. This fact often causes trouble for persons attempting to dictate strange material over the telephone.

Dr. Knudsen's tests have been conducted so far only in English. It is already suspected that Spanish will prove superior, with its large number of words ending in vowels—Valencia, Santa Barbara, poco tiempo, etc. The Chinese language may prove to be still better. To be sure, western people are often highly amused to hear a Chinese express meaning by sounding a vowel in two successive pitch tones. This may, however, prove to be the most scientific way of making one's self understood under difficulties.

Perhaps Dr. Knudsen's commendation of vowel sounds explains the great popularity of the expression which Europeans call the "American double grunt"—that is, the "uh-huh" of every-day speech. While this expression has a semblance of consonant sounds, its real merit seems to lie in the inflection pitch and time placement of vowel sounds. By variations in these factors, astonishing differences in meaning are obtained under good acoustic conditions. In short, "uh-huh" is an idea easily put over.

SEVEN FACTORS OF PERSONALITY

SEVEN primary elements that go to make up human intelligence just as the primary colors of the rainbow

may be mixed to produce the thousands of beautiful hues with which we are familiar, have been announced to the scientific world by Dr. Louis L. Thurstone, authority on mental testing at the University of Chicago. They may replace present measures of I.Q. and mental age. Four long years of research with complicated statistical and mathematical techniques enabled Dr. Thurstone to identify and name these seven "primary colors of personality." They are:

1. Number facility. This is an ability necessary to the accountant and mathematician. As Dr. Thurstone put it, "its appearance as a primary factor is not surprising in view of the common observation that many otherwise intelligent individuals seem to have a mental blind spot in dealing with numbers."

2. Word fluency. Here is a talent necessary for the political speaker, the salesman and teacher.

3. Visualizing ability. Some persons are visually minded and learn best through seeing things or pictures of them.

4. Memory. Scientific justification does exist for the disputed popular idea that memory is distinct from other mental abilities, and that a person can be described as having a good memory in general without specification as to what he can remember well. Dr. Thurstone's experimental findings agree with the common observation that people of superior intellect sometimes reveal surprisingly poor memory.

5. Perceptual speed. This is the ability that enables some people to scan a page of names or numbers to find a particular item quickly, while others must examine each item.

6. Induction. Dr. Thurstone explains induction as "involved in several tasks in which the subject must discover some principle or rule that governs the material." More experiments should reveal whether originality and inventiveness are involved.

7. Verbal reasoning. This might also be called deduction or the ability to see relations between words. The experiments showed that this is something different from mere fluency with words.

These "dimensions of intellect" which may become important for mental testing and vocational guidance, were discovered after examination of 240 university students who volunteered to take a total of 56 psychological tests. Dr. Thurstone's conclusions were embodied in a report to the American Council on Education.

CHEMICAL-INDUSTRIAL COMPETITION

WEAKENING scientific unpreparedness would certainly follow the adoption of oft-heard pleas to "stop all research for a few years, and let the world catch up." Warning against this peril was sounded by Dr. Charles M. A. Stine, vice-president of E. I. duPont de Nemours and Company, speaking before the recent Dearborn Conference on Agriculture, Industry and Science.

Not merely economic aggression by better prepared chemical-industrial powers, but disruption of American industrial and economic life by warfare in distant parts of the world, where our neutrality is not even called in

question, through the breakdown of vital raw-material supplies, could easily result from such a policy of throttling research.

"Let us not deceive ourselves," Dr. Stine said. "The world trembles on the brink of changes that may make or unmake peoples. There are menaces of war, which, should it come, would disrupt orderly trade and force us to maintain ourselves apart. Foreshadowed is the increasingly rapid introduction of new goods, new materials and new methods, some of which will be revolutionary in effect. No longer can we be sure that the raw materials, from which we made our goods yesterday, will be the raw materials with which men will work to-morrow. Man has learned the secret of material creation and a new age impends. We can't halt these changes. Regardless of what we feel or do, regardless of what laws we enact, time and progress will move on, if not in our land, then in other countries. Either we will be left behind, advance or go backward. We can't even stand still where we are. In this situation, our one insurance against being ignominiously outclassed is continued and accelerated research."

ITEMS

A WIDE-SPREAD epidemic of infantile paralysis is not expected this summer by officials of the U. S. Public Health Service. An outbreak of the disease at St. Mark's School for boys near Boston, in which eight paralytic and eight non-paralytic cases have been reported, is described as "very sharply localized" and is not expected to cause any general spread of the disease. Public health officials will not make any definite predictions on epidemics, but they point out that the extensive outbreak of infantile paralysis in the South last summer was well under way by this time of the year. If there were to be another epidemic this summer there would probably be definite signs of it by now.

ONE out of every five white persons born will eventually die of heart disease, under present conditions of mortality, a survey of deaths during a twenty-year period just completed by the Metropolitan Life Insurance Company shows. Heart disease is the chief cause of death at every age period after 45. During the period surveyed, 1911-1930, diseases of the heart, blood vessels and kidneys were responsible for more than one fourth of the deaths from all causes. A great many premature deaths from chronic diseases of heart, arteries and kidneys could be prevented by preventing childhood infections, syphilis, rheumatic fever and other infections of early life since these infections are often the initial cause of the chronic diseases that develop later and go on to a fatal end.

TWENTY-FOUR large cities have a place on the honor roll of the American Medical Association, having had no deaths from typhoid fever during the year 1935. These cities are: Bridgeport, Conn.; Cambridge, Mass.; Elizabeth, N. J.; Erie, Pa.; Fort Wayne, Ind.; Grand Rapids, Mich.; Jacksonville, Fla.; Jersey City, N. J.; Long Beach, Calif.; Milwaukee, Wis.; Newark, N. J.; New Bedford, Mass.; New Haven, Conn.; Omaha, Neb.; Paterson, N. J.; Peoria, Ill.; San Diego, Calif.; Scranton, Pa.;

Somerville, Mass.; Springfield, Mass.; Tacoma, Wash.; Trenton, N. J.; Wichita, Kans., and Youngstown, Ohio. Eight of these cities—five of them in New England—had no deaths either from typhoid or diphtheria in 1935. They are: Bridgeport, Cambridge, Erie, New Bedford, New Haven, Scranton, Springfield and Tacoma. At the other end of the scale are seven cities with high death-rates from typhoid. In the order of high mortality from the disease, they are: El Paso, Tex.; New Orleans, La.; Nashville, Tenn.; Tampa, Fla.; Norfolk, Va.; Knoxville and Memphis, Tenn.

WILD animal resources of the vast Asiatic holdings of the USSR are to be drawn upon for contributions to the Moscow Zoological Garden, by several expeditions now taking the field. The expected captures range all the way from polar bears and walrus of the Arctic to giant leopards and peacocks, and mountain sheep and goats of the mountainous region in Central Asia.

SEVEN ages of a butterfly, no less marked than Shakespeare's seven ages of man, have been studied by Austin H. Clark, of the U. S. National Museum, on one little-known species, the golden-banded skipper. During its "infancy" as a caterpillar, this insect changes its skin five times in about five weeks. Then it "pupates" as a violet-tinged white chrysalis. Finally, as the seventh stage in its life, it emerges as a full-grown butterfly.

AN all-glass engine cylinder, the only one of its kind in the world, was demonstrated at the eleventh annual aircraft engineering research conference sponsored by the National Advisory Committee for Aeronautics. Through the transparent walls of the cylinder investigators are studying the air movements and the distribution of fuel spray in research which is designed to bring greater acceleration and power output for airplane engines.

NEUTRONS have been found twelve miles up in the air above the earth's surface. The stratosphere neutrons are not as potent in energy as some of those created in the scientific laboratories, but they are much more numerous at the high altitudes. Dr. L. H. Rumbaugh and Dr. G. L. Locher, of the Bartol Research Foundation of the Franklin Institute, at Swarthmore, have reported these discoveries in *The Physical Review*. The Rumbaugh-Locher report is based on months of study of the records obtained on the stratosphere flight, last fall, of the National Geographic Society-U. S. Army Air Corps balloon *Explorer II*.

A STUDY made of a winter-sleeping bat by Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution, has been published in *The Journal of Mammalogy*. Dr. Wetmore found a hibernating bat in the folds of an awning over one of his office windows, early last winter. He put it into a blanket-fold in a small ventilated box, and left it on the window-ledge all winter long, making daily readings of the temperature. It was a winter of record cold for Washington. Temperatures as low as six degrees above zero were recorded from the bat's nest. Yet when he opened the box in early spring, the bat was none the worse for its long chilly sleep.

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COSMIC RADIATION

DR. FRITZ ZWICKY, of the California Institute of Technology, points out in the *Proceedings* of the National Academy of Sciences that cosmic rays may be responsible for some of the light received from giant stars and that the rays also produce forces sufficiently great to cause—in the course of time—astronomical changes. So far, Dr. Zwicky intimates, only the terrestrial aspects of cosmic rays have been studied.

Cosmic rays may be expected to be scattering continually the clouds of gas molecules which are thought to be the first step in the formation of a new galaxy of stars. Gravity is the force which tends to build up these clouds of molecules. Thus, contends Dr. Zwicky, astronomers may some day need to consider cosmic rays as an additional force acting when they construct their astronomical hypotheses. No corner of interstellar space escapes these tiny bullets. Wherever they hit matter they break up atoms, and wherever atoms are dismembered light is emitted when the pieces come together again.

The faint glow of the sky on clear moonless nights is partly due to this unceasing rain of high-speed particles. Likewise the luminosity of comet tails, certain interstellar gas clouds and outer atmospheres of giant stars may be due in some measure to this cosmic bombardment.

No one knows, as yet, just where cosmic rays come from or how they acquire their enormous energy. Some kind of super-thunderstorm in stars may create them. In any case they form a sort of contact between different stars and galaxies. Light is not the only messenger which one star sends to another. Actual material substance in the form of speeding atoms, ions and electrons, are shot out from one stellar body and absorbed by another. Professor Zwicky points out that this dissemination of matter and energy throughout the universe "may play an essential rôle in the evolution of stars and galaxies."

A 1,200,000-VOLT X-RAY TUBE

PRODUCTION of medical radiation greater than all the refined radium in the world is one of the advantages claimed for the super-x-ray machine being constructed by the Kelley-Koett Company at Covington, Ky. It is estimated that it would cost \$100,000,000 to produce sufficient radium to equal the quantity of radiation available in the super-x-ray.

The machine, the largest in the world, will be used in the treatment of cancer. Four patients can be treated at one time by use of the 1,200,000-volt apparatus now being built for the Miller Hospital, St. Paul, Minn. The cost is approximately \$75,000.

The 27-foot tube, in which electrons will bombard a gold electrode to create the radiation necessary for cancer treatment, has already been completed. Tubes in ordinary x-ray machines are dwarfed when placed beside the gigantic "medical battlefield."

When complete the machine will be 35 feet high, 24 feet wide, 33 feet long. Ordinary x-ray machines are

100,000-volt equipments. A few 800,000-volt and 400,000-volt machines are in use.

Not only will the radiation of this new giant of the medical world be greater than that of the world's supply of refined radium, but the machine's radiation will have greater penetrating power. The tube itself is protected with four inches of lead to prevent the radiation except where it is desired. Three feet of concrete will separate the tube from the operator, when it is installed, to protect him from radiation.

The object of the super-ray is to penetrate into the body to treat cancers which can not be treated at the present time because of burns which would result. The great penetrating power makes treatment possible where serious x-ray burns would result on the skin with less penetrative machines.

The target of the tube, or the x-ray producing electrode, will be of gold, five inches in diameter and one sixteenth of an inch thick. Gold is used because of its high atomic weight. The electron streams bombarding it will produce a more penetrating radiation than with metal of less atomic weight. Ordinarily, tungsten is used for such targets. Another reason for the use of gold is that the electrons strike it with such speed and hit so hard that the target would be melted if a metal of less heat conductivity were used. Even the gold is backed up with a water-cooling jacket.

The tube itself is of indestructible porcelain and metal. Oil will be used to cool the target and water for cooling the oil. A two-way microphone loud-speaker communication system will be provided to permit conversation between operator and his patient. A periscope will permit the operator to see into the treatment room and observe the patient at any time during treatment.

The machine will be ready for installation in the Miller Hospital, St. Paul, on about August 1.

SUBMARINE CANYONS

DISCOVERY of three hitherto unknown submarine canyons is reported by Professor Francis P. Shepard, who has just returned from a cruise on the U. S. Coast Survey ship *Oceanographer*. Professor Shepard's participation in the survey was assisted by a grant from the Geological Society of America.

The canyons are cut deep into the sea bottom off the Middle Atlantic region of the United States. They lie to the southwest of the great submarine Hudson Canyon, which continues the Hudson Valley far under the ocean from the mouth of the present Hudson River.

The greatest depth of the floors of the three new-found canyons is 7,000 feet below sea-level. Their walls rise above this level 1,000, 1,500 and 2,000 feet respectively. The deepest of the three is the southernmost. This canyon is located approximately off Toms River, N. J., and cuts back into the continental shelf for about three miles. The other two terminate headward below the shelf margin.

All these canyons extend directly down the continental shelf slope in the direction which would be expected of streams if the sea-level were lowered, and their shapes are decidedly those of stream-cut canyons.

Professor Shepard has plotted the 4,700 soundings of the recent Hudson Canyon survey on a large scale. He states: "This is the most complete deep-water survey ever made and probably the most successful of the surveys to date. The canyon is much straighter than previously supposed, being practically identical in character with the canyons off Georges Bank in having a maximum wall height of 4,000 feet; but the hundred-fathom curve is bent shoreward sixteen miles as compared to thirteen for the largest of the Georges Canyons. The walls are not quite as deep in the case of the Hudson Canyon. The bottom declivity is fairly uniform, but shows an increase between 3,500 and 4,500 feet, which is probably due to the outcrop of a harder layer along the canyon course.

"Inside the canyon, as was known previously, a valley only about sixty feet deep extends almost into New York. This shallow valley is only a few feet deep where it joins the head of the canyon. It was probably caused by a small lowering of sea-level rather than by the great emergence which is implied by the deep canyon, which cuts the continental slope of the world."

HELIUM AS A PREVENTIVE OF CAISSON DISEASE

HELIUM, now used to lift men into the air, may find a new use in treating those who go underground or under the sea and who, working under compressed air, contract caisson disease, it appears from recent investigations on its solubility in the blood, reported by Drs. J. A. Hawkins and C. W. Shilling, of the Experimental Diving Unit at the U. S. Navy Yard.

The "bends," an exquisitely painful malady which affects workers who are exposed to air at high pressure, is caused by the blood's taking up a great deal of nitrogen from the air. When the workers come into normal air pressures, this forms bubbles in their veins, and may result in permanent crippling or death. Even the most modern methods of bringing men from high pressures to those of the atmosphere slowly do not entirely obviate the danger of the bends.

Helium, like nitrogen in that it is an inactive gas and plays no part in the actual requirements of the body, is less soluble in water than is nitrogen. Under pressure, less would dissolve in the blood, and what did dissolve would be more rapidly dissipated if helium were substituted for nitrogen in the compressed air supplied to divers. This would cut down on the danger from caisson disease.

However, Dr. P. A. VanSlyke has found that the solubility of other gases, like hydrogen and nitrogen, is different in the blood than in water. To check up on this Drs. Hawkins and Shilling have investigated the gas' solubility in dogs' blood. They used the standard method for this kind of work, mixing air containing known amounts of helium with dog blood, treated to prevent its clotting, in special bottles known as tonometers. When

the mixing has gone on for a definite time, the remaining air is analyzed to find out how much of the helium was dissolved and so removed from the air.

Their results show that helium is just about as soluble in blood as in water, and that its use in preventing the bends is feasible. Helium has also recently been found a valuable aid in the treatment of asthma.

THE YELLOWSTONE BISON

THE American bison—buffalo to most people—which staged such a spectacular come-back in Yellowstone National Park when conservationists and the public generally thought it was about ready to join the dodo, now has a new home in the park. The main herd, since its establishment in 1902, has kept in the vicinity of the Lamar River Valley in the northeast section of the park. Now a small herd has been transplanted to Hayden Valley, one of the ancestral ranges of the buffalo of the gay nineties. Hayden Valley is in about the center of the park, near Yellowstone Lake.

In all, 36 buffaloes have been moved to Hayden Valley, including 16 bulls, 13 cows and 7 of this year's calves. They made the journey by truck. It is expected that they will stay in the vicinity of Hayden Valley and Mary Mountain, where grass is abundant, and that they will have no difficulty in wintering there, since it was a natural buffalo range at the close of the nineteenth century.

The transplanting of this herd of buffalo serves three primary purposes, according to Joseph Joffe, assistant to the superintendent of Yellowstone National Park. It will help alleviate conditions on the over-grazed Lamar River range, will by its success or failure indicate the wisdom of making similar experiments elsewhere in the park in the future, and, most important of all from the standpoint of the visiting public, probably will make it possible for motorists along the Lake-Canyon road to catch an occasional glimpse of a buffalo in his wild state.

For several years a show herd of buffalo has been kept in a corral on Antelope Creek, being moved there each spring and returned to the buffalo ranch in the fall. This show herd is easily accessible to park visitors and very popular with them.

SHADE AND SUNLIGHT

WHETHER a stand of timber is "ripe" enough for cutting can be judged by measuring the degree of shade the treetops cast, W. G. Morris, of the Society of American Foresters, indicated in an address before the meeting of the Ecological Society of America at Seattle on June 17.

The method is very simple. The forester walks through the forest, carrying in his hand a pocket-size electric photometer, of the type used by photographers to gauge the light they have to work by. This shows the amount of sky light passing through the forest canopy, in terms of figures on a dial. From time to time he notes down the readings, and at the end of his trip he averages them up. The density of the forest canopy thus measured is

an expression of the maturity and harvest-readiness of the forest.

Desert-dwelling reptiles are no fonder of the hot sun than are any other cold-blooded animals. The old-time notion that rattlesnakes and Gila monsters like to bask on a hot rock—the hotter the better—was dispelled at the meeting of the Ecological Society of America by Dr. Walter Mosauer, of the University of Southern California.

“Diurnal lizards and nocturnal snakes alike are killed by a short exposure to desert sunlight,” he said, “especially if they are placed on the sand which reaches temperatures of 70 degrees Centigrade and over, around noon during the spring months. But even if they are suspended freely five feet above the ground, the direct isolation alone is lethal.”

Forests of the states of Oregon and Washington, among the most important of surviving American timber stands, have been accurately mapped by the U. S. Forest Service and the maps are now being lithographed by the U. S. Geological Survey. This work, important both scientifically and economically, was outlined before the meeting of the society by T. T. Munger, of the U. S. Forest Service.

Twenty-six distinct types of forest are to be represented on the finished map, each type shown in a distinctive color. Logged-over and burned-over areas will also be shown.

ITEMS

PRODUCTION of a film—chemical, not cinematic—one hundred times thicker than most chemists thought could exist was announced by Professor William D. Harkins and Dr. Robert J. Myers, of the University of Chicago, at the opening of the Thirteenth Colloid Symposium of the American Chemical Society at St. Louis. Films possible in surface chemistry have been thought to be not more than one molecule thick. These films are from two to 100 molecules thick. Significance of the discovery is that science hopes to find more facts about the films which cover many parts of the human body and brain. “Without these films and related membranes life would be non-existent,” said Dr. Harkins. “The motion of the muscles, the behavior of the nerves and the brain itself, and the characteristics of the blood and all the cells of the body are dependent upon the action of such films.”

“NO TRESPASSING” signs are written in some kind of unexplored chemical language by growing roots, to keep other roots from invading territory which they have taken for their own. Indications of this are graphically shown in a device invented by Professor M. A. Raines, of Howard University. Professor Raines’s method makes the root systems of plants visible throughout their entire growth. Against a slightly sloping sheet of glass he lays a sheet of dark paper or other absorbent material, kept moist by a series of wicks dipped into a supply of water. The roots sprouting from seeds placed at the top edge of the sheet grow down the moist paper and can be studied in detail. One of the things shown by roots of two young plants grown side by side on the same sheet is that when two young tips approach, they do not actually make contact, but when they are still a little distance apart,

each bends aside a little and they then grow parallel. When the tip of a young root approaches the trunk of an older root running athwart its path, it also bends aside before actually touching it and runs down parallel with the older one. What the influence is, that thus deflects roots before they actually touch the solid substance of another root, Professor Raines does not yet know, but he regards the secretion of some repellent chemical compound as the most likely hypothesis.

A MAN-MADE sponge that may prove to be superior in many ways to the natural product is a new achievement to be added to those of the chemist. The sponge is manufactured of highly purified wood and cotton cellulose, its spongelike appearance being due to chemical reactions and can be employed for all purposes to which sponges are ordinarily put. The new synthetic sponge is tough and durable but becomes quite soft and pliable when wet, thus precluding any possibility of scratching the most highly polished surface. It will outlive the natural product, according to a report in *Industrial and Engineering Chemistry*. This man-made sponge is resistant to cleaning compounds, soaps, greasy matter and grit; is uniform in quality, size, shape and texture; is free from odor and, since it floats, does not pick up grit and other foreign matter. It can be trimmed to any desired size without damage to its texture or durability, and can be used for washing, polishing and drying almost any surface without the aid of towels or chamois.

FIREPROOF fabric knitted out of spun threads of asbestos is the invention of a Leningrad inventor, M. Semenovich. Garments made of the new material are stated to be quite unlike the heavy, armor-like safety suits heretofore made of asbestos; they weigh only about four pounds to the suit, and are as comfortable and well ventilated as wool. Tests made by workers wearing suits and gloves of asbestos fabric sound like tales of almost demon-like immunity to fire. The wearers picked up red-hot rods of metal and bent them as if they were soft wax. With suitable respirators, firemen walked right through flames to the very heart of the fire they were seeking to conquer. Large-scale manufacture of the new stuff has been undertaken in the USSR.

JUST as the carbon dioxide gas in the seltzer bottle forces the soda out of the spout, so it could quickly discharge the gasoline from the fuel tanks of airplanes in flight. Thus in an emergency landing the plane would hit the ground with no gasoline in the tanks to catch fire or explode. Instead tanks would be filled with non-inflammable carbon dioxide gas and danger of fire would be eliminated. This is essentially the principle upon which a patent has recently been granted here to John Hays Hammond, Jr., son of the famous engineer. According to the invention, each plane would carry a cylinder of compressed carbon dioxide or some other non-inflammable gas under pressure. By pipes, the cylinder would be connected to the fuel tanks and to piston-operated valves, one of which would cut off the supply of gasoline to the carburetor and the other of which would simultaneously dump the gasoline into space.

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SCIENCE NEWS

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NOVA CEPHEI

NOVA CEPHEI, the brilliant new exploding star discovered simultaneously on the night of June 18 by four independent observers in this country and Europe, gives indications that it may become brighter.

The nova, first to come into view since the famed Nova Herculis in 1934, is the same type of exploding star as its predecessor. Located in the constellation Cepheus in the Milky Way, the body is of the third magnitude and easily visible to the naked eye. It is a little north of the zenith at 4 A.M., but in high northern latitudes it is visible all night. It can be seen two degrees southwest of the familiar variable star, Delta Cephei.

Word of the discovery was received at Harvard College Observatory, the clearing house for astronomical news in the Western Hemisphere, from four observers. They are Leslie C. Peltier, Delphos, Ohio, amateur astronomer who a few weeks ago discovered a new comet in the same part of the sky; Eppe Loreta, of Bologna, Italy; A. V. Nielsen, of Aarhus, Denmark, and C. Hoffmeister, of Sonneberg, Germany. News of the discovery has been flashed to observatories all over the world and already data concerning this important stage in the development of the nova are being received.

The Yerkes Observatory has reported the magnitude as 2.9, and places it in the high temperature class, "B-9." According to Dr. Otto Struve, director of the observatory and a specialist in the study of stellar spectra, the star shows diffuse hydrogen and magnesium absorption lines as well as strong interstellar calcium lines. The rate of explosion is estimated about 1,000 kilometers or more than 600 miles per second.

Observations made by Dr. Dean B. McLaughlin at the University of Michigan, communicated by its director Dr. H. D. Curtis, confirm those made at Yerkes Observatory.

Astronomers all over the world are observing the star, for, like Nova Herculis, it is capable of contributing valuable information on the nature of stars and evolutionary processes in general throughout the universe.

ACTIVITY OF THE STARS

THE inside of a star is a factory which makes complex elements out of the simplest element of all, namely hydrogen. This is the point of view presented to the American Physical Society, meeting at Seattle on June 19, by Dr. R. M. Langer, of the California Institute of Technology.

The output of the factory is not complex elements but energy which is radiated away as the star shines a few billion years. The complex atoms are left behind mostly in the form of iron. Only a minute fraction of the energy of a single star, the sun, is caught by our earth and this energy is what makes our factories work to make complex things out of simple ones.

The stellar factory would blow up in its enthusiasm for energy production were it not for the stabilizing effect of the complex atoms. Of these the most important

stabilizer is heavy hydrogen. When things get too hot heavy hydrogen breaks up into a neutron and an ordinary hydrogen atom and things are back where they started.

It is this accident of the balance between neutrons and deuterons which determine how hot the star becomes and how long it lives. The internal temperatures are about half a billion degrees and the life is several billion years. According to Sir James Jeans the stars shine much longer than that, but few agree with him. No process known to happen is competent to keep a star going over ten billion years. No process known is able to heat a star over a billion degrees because the radiation at that temperature would exhaust any process ever suggested before that temperature would be reached.

At these high temperatures matter is quite different from the matter we know. No compounds exist. No solids or liquids are possible. Neutrons, positive electrons and deuterons, all newly discovered and rare on the earth, abound. Above all and predominating everything photons of light fierce as x-rays rage to and fro. Nothing is safe from their influence. They create matter and are created by matter. Things are so lively that we can never hope to make any direct experiments under these conditions. Yet the basis for Dr. Langer's calculations are the experiments which are being made in many laboratories with comparative ease shooting atoms at one another at high speed and scoring the hits.

NEW HIGH-VOLTAGE SYSTEM

AN improved system of generating extremely high voltage in which the equipment is virtually "wearless," has been developed by Dr. Odd Dahl, physicist of the Department of Terrestrial Magnetism at the Carnegie Institution of Washington. It has potential use as a cheap form of apparatus with which to disrupt atoms.

Like the great electrostatic generator of Dr. Robert Van de Graaff, of the Massachusetts Institute of Technology, which works on principles of electrostatic electricity known for half a century, the new device of Dr. Dahl goes back fifty years to the old rotating disk type electrostatic generator used by the German investigator Holz in the 1870's.

But unlike the Van de Graaff device which carries its electrical charge bit by bit on a paper belt to an insulated sphere and thus creates high voltage, the new Carnegie equipment uses insulating plates on a whirling disk to carry the electrical charge over to the storing terminal.

The disk, spinning 1,350 times a minute, passes through a space in which there is ionized air from a corona discharge and picks up the charge. There is no direct rubbing contact and hence very little wear in the apparatus other than the normal wear on bearings in the electrical motor drive and in the shaft of the disk.

With a small, compact design of equipment, Dr. Dahl has obtained a potential of 220,000 volts and drawn currents of from 10 to 30 milliamperes. This is ten times

as much electric current as can be obtained from the giant Van de Graaff generator of the Massachusetts Institute of Technology or from the 1,200,000 electrostatic generator in the laboratory of the Carnegie Institution in Washington.

To obtain electrical pressures of over 1,000,000 volts, Dr. Dahl suggests that a number of these small whirling disk units could be connected together in tandem so that the voltage output would be additive. It is believed that the ultimate limit of the voltage would only be determined by the insulating difficulties.

A NEW INSULIN COMPOUND

THE advantages of protamine insulin over ordinary insulin in the treatment of certain cases of diabetes were described by one of the co-discoverers of insulin, Professor C. H. Best, of the University of Toronto, at the Vancouver meeting of the Canadian Medical Association.

The new kind of insulin was developed by Danish investigators. It was not intended to supplant ordinary insulin in cases of diabetes which can be satisfactorily controlled by insulin alone, but was found a valuable adjunct to insulin in treating cases of severe diabetes. Protamine insulin is relatively insoluble and tends to be absorbed slowly and over a longer period of time than ordinary insulin. Consequently its blood sugar-lowering effect lasts longer—twice as long, in fact.

"The work of the Danish group on protamine insulin has been abundantly confirmed," Dr. Best said. "Various groups of clinicians in Boston, Toronto, London, Eng., and Rochester, Minn., have found that the duration of insulin action is much extended when insulin is combined under appropriate conditions with protamine."

Dr. Best and his associate, Dr. Robert Kerr, found that dogs having no insulin-producing pancreas tissue could be kept free from symptoms of diabetes by one injection of protamine insulin daily. At least two injections of regular insulin are needed to accomplish this result. The fluctuations observed in the amount of sugar in the blood when regular insulin is used are avoided with protamine insulin.

The use of protamine or some even more satisfactory agent will make it possible, according to Dr. Best, to maintain certain diabetic patients in a much more normal condition.

DEATHS FROM DIPHTHERIA

LAURELS and censure are awarded to American cities by the American Medical Association. The laurels go to the nineteen large cities whose 1935 records show not a single death from diphtheria. The censure is applied to ten other cities whose high death-rates from diphtheria show that they do not appreciate what can be done to protect their children from this dangerous disease.

Knoxville, Tenn., had the highest diphtheria rate in the United States during 1935, with 13.6 deaths per hundred thousand population. Baltimore, Md., where the campaign for diphtheria prevention by immunization has been carried on actively, had the wonderful record of not a single resident death from this disease for one year and sixteen days.

"What is the matter with the other cities along the South Atlantic seaboard?" asks the editor of the association's journal. "One would expect Washington, D. C., to have as low a rate as Baltimore, but the average diphtheria mortality has been nearly ten times as great."

"Cities like Miami and Tampa, Fla., with a 'good climate' ought certainly to bring their diphtheria rates down to a level with those of the cities in 'bleak' New England and central New York."

Peoria, Ill., had a very high death-rate during the first six months of the year. Improvement in the second six months, as a result of immunization of children, drew from the medical journal editor the comment: "It should not be necessary to wait until a considerable number of children are attacked before general immunization is undertaken."

THE THREAT OF GRASSHOPPERS

GRASSHOPPERS are again a major threat to crops in the West, due to high temperatures and lack of rain during early summer. And in most places ammunition to fight them is lacking. Unless the Congress acts, during its closing hours, on a resolution to transfer already appropriated but still unused funds from the chinch-bug appropriation of last year, disaster may await grain crops and pastures.

The situation is described by the U. S. Bureau of Entomology as "serious" in Oklahoma, Kansas, Nebraska, Montana, southern Iowa, and a few counties in northwestern Illinois. It is not yet serious in North Dakota, but is expected to become so very soon. South Dakota prospects are not so bad as they are elsewhere in the Northwest, though there is cause for concern in that state also.

What makes the situation particularly critical at the present juncture is that none of the states has funds of its own available for the purchase and distribution of poison bran bait, the standard means of anti-grasshopper combat. Neither is there any federal appropriation available for that purpose. The state legislatures will not meet until next year, and the Congress is about to adjourn. The one possibility lies in an anti-chinchbug fund provided last year, but left unused when natural bug-abating factors came to the aid of the farmers. A joint resolution is pending before the Congress to divert a part of this fund for grasshopper-fighting purposes, but speed will be needed to push it through before adjournment.

In one state only can the situation be met under the existing conditions. In Kansas, the county commissioners have authority to levy a special county "grasshopper tax" upon petition of a sufficient number of farmers. In some counties this has already been done.

FERTILITY OF VOLCANIC COUNTRIES

VOLCANOES are far from being only smoking, portentous menaces to human life and property. Tropical countries where active volcanoes abound have the most productive soils in the world and are capable of sustaining large populations, according to Dr. E. G. Zies, of the Carnegie Institution of Washington.

Dr. Zies has conducted extensive researches on the relation of human life to volcanoes, recently leading an expedition into the highly volcanic country of Guatemala, in Central America. Most of Guatemala's population of 2,500,000 live on a belt of rich, porous, light soil formed of volcanic products. The fairly frequent falls of fine volcanic ash only add to the richness of the soil, and when one occurs toward the end of the rainy season it acts as a dust mulch, conserving soil moisture and insuring an unusually good crop for that year.

The one big difficulty with the volcanic-ash type of soil is its high susceptibility to erosion. The torrential rains and "flashy" rivers of the country cut it into deep, steep-sided arroyos, which make both farming and transportation difficult. The soil eroded from the uplands, however, is not entirely lost; it appears again on the lowlands after the floods have spread it out.

As an example of what can be done with a wholly volcanic land in the tropics, Dr. Zies pointed to the island of Java. Here, an industrious, frugal native people, under the scientific leadership of the Netherlands Government, maintains the astonishingly high population level of over forty millions, on an area of 36,000 square miles—about the size of the state of Iowa.

ITEMS

A SUCCESSFUL method of inoculating against the ancient and much-dreaded disease, plague, is claimed in Russia. Protection or immunity is given by inoculations with a culture of harmless plague germs developed by Dr. M. P. Pokrovskaya, senior scientist of the Plague Combating Station in the Northern Caucasus. To test the effect of the germs on human beings, Dr. Pokrovskaya and the director of the station, Dr. I. S. Erlich, inoculated themselves. The germs had been made avirulent, or harmless, by treatment with bacteriophage. Inoculation of animals with these treated germs made them immune to deadly doses of plague bacilli.

LOOKING their wounds, a practice universal among animals, has good bacteriological justification, is reported by Dr. Herman Dold, professor of hygiene at the University of Tübingen. Cultures of bacteria to which saliva was added failed to thrive, while untreated "control" cultures grew flourishing colonies of the germs. It therefore appears likely that in addition to keeping dirt and hair out of their wounds by the constant licking, the afflicted animals are also applying an effective antiseptic.

THE office of the U. S. Forest Service in San Francisco reports that the white pine blister rust, that most serious disease of the highly valuable white pine group, is now only about twenty miles from the northern boundary of California, the only remaining uninfected large area of this timber type. The disease, which is caused by a fungus, came from Europe. After ravaging the remaining white-pine stands of New England and other northeastern states, it made its way to the Pacific Coast lumber region by way of Canada. Efforts of the Forest Service, especially since the inauguration of the C.C.C., have held it somewhat in check, but have not availed to stop its spread entirely. The fungus spends part of its life on the leaves of currants and gooseberries, and only the

total destruction of all bushes, both wild and cultivated in the neighborhood of the trees will stop it. The extermination of all such bushes in the rugged Northwestern timber country presents an appalling task.

Two encouraging communiques are received from the front in man's continual war on the insects. Aerial warfare of a new sort is to be used. An autogiro will spray poison upon canker-worm infested trees in Morristown, N. J., National Historical Park. Airplanes have successfully dusted and sprayed cranberry bogs and cotton fields in the past, but the autogiro, moving more slowly and landing with less area, promises an improvement. Poison is used freely in fighting insects. The use of arsenic containing sprays upon apples and other foods has been criticized. Not because it doesn't kill the insects but because it may harm those who eat the food. Now a chemist of the Department of Agriculture has developed a new insoluble nicotine insecticide by combining the poison of tobacco with peat. Widely distributed, peat is an organic type of soil which might be called coal in infancy. The new nicotine peat may control chewing insects as well as hazardous inorganic insecticides such as those containing arsenic, lead and fluorine. Nicotine is an old favorite among insecticides, but has been applied usually dissolved in water.

A BLOOD test which has proved valuable in determining the probable outcome of pulmonary tuberculosis is described by Dr. A. H. Duncan, of the Muskoka Hospital for Consumptives, Gravenhurst, Ont., in a report to the Canadian Medical Association Journal. The test is made by drawing a sample of blood into a slender, upright tube and noting the rate at which the red cells settle out as sediment. Why the red blood cells should form a sediment at a different rate in disease and in health is not definitely known, but the rate of sedimentation seems to indicate the degree of tissue break-down going on in the body. This test is said to show the activity of pulmonary tuberculosis with an accuracy of 94 per cent. and gives more reliable information about the patient's condition than can be learned from such signs as fever, pulse rate, cough, sputum, loss of weight and the like.

RADIUM, followed by heat or pressure, explains a beautiful but puzzling blue color found occasionally in natural salt crystals, according to Professor Karl Przibram, of the Institute for Radium Research of the Vienna Academy of Sciences. Blue salt crystals have been known for a long time, but until after the discovery of radium and radioactivity there was not even a conjectural explanation of their cause. Then it was suggested that irradiation by radioactive elements was responsible for the blue color. Dr. Przibram and his pupils tested the theory in the laboratory, irradiating ordinary salt crystals with radium rays. The colorless crystals did take on color—but the color was yellow. Only when the yellow crystals were heated or put under pressure did the blue color appear. Yellow rock-salt crystals were unknown in nature, so the research appeared to have run into a blind alley. Lately, however, a salt mining engineer, O. Schauburger, found some natural yellow crystals in a salt mine in the Tirol. When heated in the dark, these crystals turn blue.

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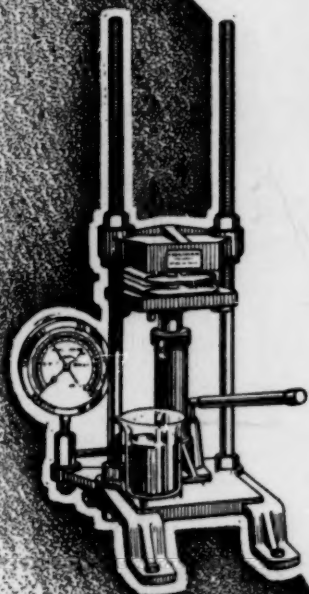
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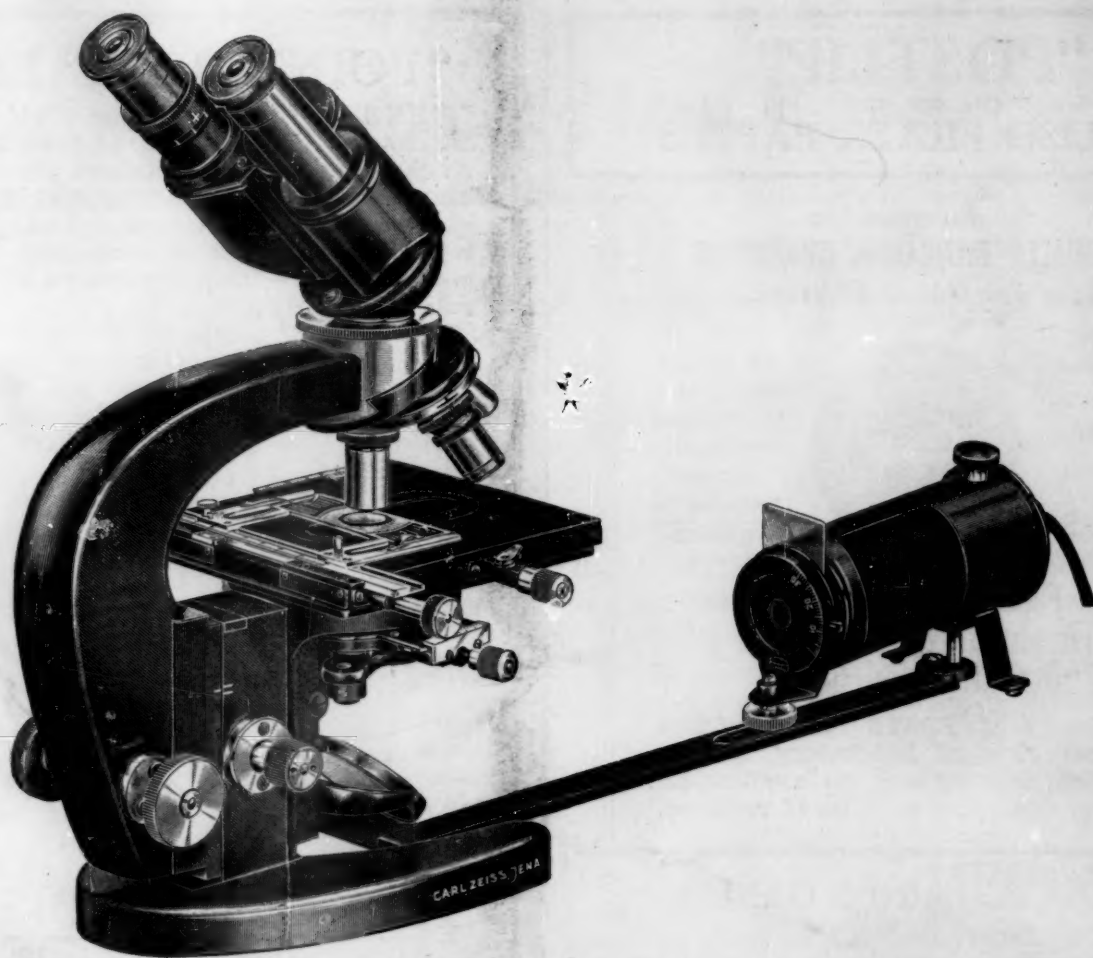
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